SOUND DEVICES

702T

High Resolution Digital Audio Recorder with Time Code
User Guide and Technical Information
firmware rev. 2.65

CF

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TIME CODE

FireWire

backside - front cover

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Welcome

Thank you for purchasing the 702T digital recorder. The super-compact 702T records and plays back audio to and from CompactFlash, making field recording simple and fast. It writes and reads uncompressed PCM audio at 16 or 24 bits with sampling rates between 32 kHz and 192 kHz. It also writes and reads data compressed FLAC and audio compressed MP2 and MP3 files. The time code implementation on the 702T extends its usefulness in audio-for-picture applications—from over-the-shoulder to cart-based production.

The 702T implements a no-compromise audio path that includes Sound Devices' high-resolution, discrete microphone preamplifiers. Designed specifically for high bandwidth, high bit rate digital recording, these preamps set a new standard for frequency response linearity, low distortion performance, and low noise.

With documentary and ENG sound engineers in mind, the 702T is very small, while still being feature-rich. No other recorder on the market matches its size and feature set. In addition, its learning curve is quite short—powerful does not mean complicated. While the 702T is a very capable recorder by itself, it truly excels when used in conjunction with an outboard audio mixer such as Sound Devices' own 442 or 302.

Sound Devices took advantage of the best in professional and consumer electronics technologies to bring incredible feature depth with ease of use. CompactFlash media is highly reliable, industry standard, and easily obtainable. The removable, rechargeable battery is a standard Sony-compatible Li-ion camcorder cell. The 702T interconnects with Windows and Mac OS computers via FireWire for convenient data transfer and backup.

702T Firmware Known Issues

For a complete list of known issues regarding the most current firmware please visit Sound Notes.
http://www.sounddevices.com/notes/recorders/known-issues/

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Quick Start Guide

The 702T is an extremely powerful and flexible portable audio recorder. Before recording, please familiarize yourself with the product. Several settings should be verified or set based on individual recording needs.

Powering the Unit

1. Apply power to the unit by attaching the (included) removable, rechargeable Li-ion (lithium ion) battery to the back panel battery mount. The metal tabs on the mount line up with the electrical contacts on the battery. From the factory, the battery may not have a charge, so external DC may be needed for initial operation and charging. Connect the included AC-to-DC power adapter to the DC input plug to power and charge the battery.
2. Press and hold the power button to turn on the unit. Press and hold the power button to turn off the unit.

If this is the first time the recorder has been powered, or if it has been without a battery for an extended period, the date and time may need to be set.

Charge the included Li-ion battery for 6 hours prior to initial use.

Menu Navigation Basics

The Setup Menu provides options for recording, routing, and control. The single layer menu structure allows for very quick navigation and function selection. To enter the Setup Menu press the front panel Menu (MENU) button. Once in the Setup Menu, the following conventions are shared for navigating among selections and to select specific parameters.

- (MENU) Menu Button- enters Setup Menu
- **›ITEM‹** - highlighted menu item
- ✔ - selects highlighted item or parameter
- ↑ - moves up in menu and between menu parameters
- ↓ - moves down in menu and between menu parameters
- ✘ - exits the selected function or Setup Menu altogether
- The (■) Stop button will exit from any menu and cancel any changes. Use it to escape out of the Setup Menu.

The right panel Rotary Switch (labeled “Select”) is a convenient control to quickly navigate among menu items and item options. Its push-to-select function duplicates the check mark in most menus.

Connecting Audio Sources

1. Connect audio sources, either analog or digital, to the appropriate input connector.
2. Set the appropriate input level—mic, line, or digital (input 1)—with the adjacent slide switch.
3. If mic-level inputs are used make certain that phantom power, input limiters, and high-pass filters are activated as required.

Routing Inputs to Tracks

Before recording, inputs **must** be assigned to tracks. Each 702T input (1 and 2) can be assigned to the two recorded tracks (A and B). These 16 possible routing combinations are shown on the front panel with 4 blue LEDs. Illuminated LEDs indicate input-to-track assignment.

1. Press and hold the STOP button then press the INPUT button to cycle through factory routing presets. The 702T has several often-used presets for quick setup of input-to-track routing combinations. Note the routing combinations on the blue LEDs with each successive press.
2. If none of the preset routing combinations are suitable, assign a custom routing. Sequential presses of the input button will eventually cycle to the custom routing option (see *Input to Track Routing, pg. 18*). From the custom input routing menu any input can be assigned to any track, including multiple inputs assigned to a single track.
3. Press **EXIT** to leave input routing mode.

If no input is assigned to a track the 702T will not record.

Selecting Recording Parameters and File Destination

For most productions, the general recording parameters of bit depth, sampling rate, and file format are infrequently changed. Enter the Setup Menu to verify recording settings. Bit depth and sampling rate are displayed on the LCD panel.

1. Select the bit depth as needed.
2. Set the sampling rate as needed.
3. Select the file type, WAV mono or WAV poly, FLAC, MP2, or MP3.
4. Select the storage volume(s) (CompactFlash, External drive, or any combinations of the two drives) for recording.

Time Code Setup

When using a time code workflow, proper time code setup is essential for accurate sync of picture and sound. Skip this section if time code is not being used.

1. Select a time code frame rate appropriate for your project. For film production, typical the time code rates are 30 fps non-drop (NTSC) or 25 fps (PAL). For standard definition video projects, use either 29.97 or 29.97 non-drop. For high-definition projects, use either 23.98 or 29.97, depending on what post workflow or format is used.
2. Select the time code run mode: free run, record run, 24 hr. run, or one of the external run modes.
3. Typically, the 702T is used as the master clock source and all other cameras and slates are jammed to it. This will assure that every device is using the same time reference. (See *Time Code* for additional information on time code setup).

Recording

With file parameters set, the 702T is ready to record. The 702T is a record-priority device—pressing the record button cancels all functions, except file-based operations, and immediately begins recording a new sound file. When record is pressed, the red record LED illuminates to confirm that the unit is recording. The file name on the LCD display shows the currently recorded sound file. Press and hold the STOP button to end recording.

Playback

When recording is stopped, the most recently recorded file is immediately available for playback. Press the button to start file playback from the beginning of the file.

To select files for playback:

1. Press and hold the button to enter the File Viewer and navigate among sound files and folders for playback. The folder of where the most recent file was recorded is opened when the button is pressed.

2. Use either the Rotary Switch or the arrow soft-buttons, to navigate through file folders.
3. Once a file is highlighted, press the ▶ play button to begin playback.

When playback has finished, the filename will flash on the LCD display. Use the » fast-forward button or « rewind button to step through files in the folder, or press the ■ stop button to exit playback mode.

FireWire File Transfer

Sound Devices strongly recommends shutting down equipment before connecting to or from any FireWire device with a connection that carries power (6-pin). Reports have come to our attention of isolated problems when hot-plugging IEEE 1394 (FireWire) devices. (Hot-plugging refers to making the connections when one or more of the devices—including the computer—is on.) When hot-plugging, there are rare occurrences where either the FireWire device or the FireWire port on the host computer is rendered permanently inoperable. From our experience, any FireWire connection which carries power is susceptible to this type of damage.

When connected via FireWire (IEEE-1394a) to a Mac OS or Windows OS computer (*see Specifications for computer requirements*), the CompactFlash card mounts onto a computer as "letter" accessible, removable storage media. This effectively makes the 702T a card reader for CompactFlash cards. Use the appropriate FireWire cable (6-pin to 4-pin or 6-pin to 6-pin) for interconnection. From the computer files on the 702T CF card can be treated as if they are local files, including renaming files, copying, deleting and playing directly through the 702T.

In general, it is good practice to transfer sound files from the 702T to a computer before any processing is performed on the files.

To connect the 702T for FireWire transfer:

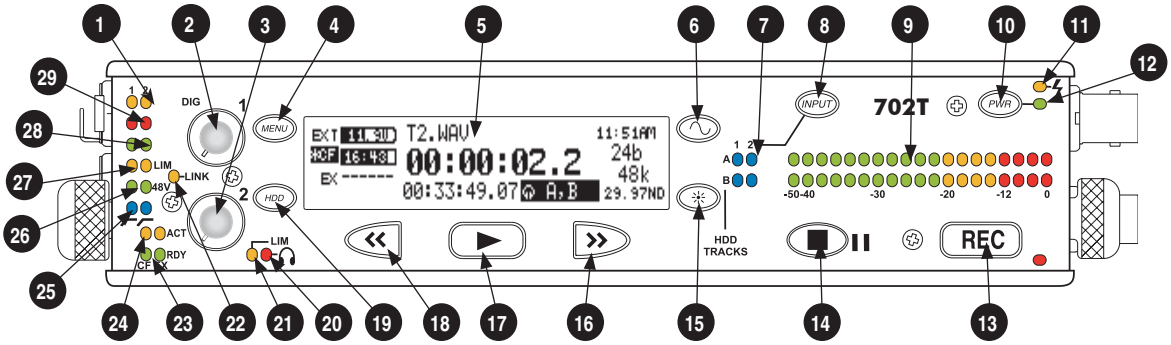
1. Stop all playback and recording, then shut down the recorder
2. Make certain the 702T battery is fully charged, or that the unit is connected to external DC.
3. Connect the 702T to the host computer with a FireWire cable.
4. Power the 702T.
5. Initiate connection to the computer by accessing the **`FIREWIRE: CONNECTION`** menu option in the Setup Menu. Select **`COMPUTER/CONNECT`** or if this has already been selected simply hit STOP then the HDD key to initiate a connection to the computer. The 702T will enter FireWire transfer, indicated by **`FIREWIRE CONNECTION`** on the LCD display. All functions of the 702T are stopped while the 702T is connected to a computer through FireWire.
6. Navigate to the attached drive from the computer and copy all needed sound files to local storage on the computer.

To avoid possible corruption of data on the CompactFlash card, do not interrupt the connection process and always properly dismount (eject) the drives from the operating system. On Mac OS platforms, drag the drive icons to the trash. On Windows platforms, right-click the 702T volume and choose eject.

Dismount the 702T after file transfer by "ejecting" the volume from the computer. In Mac OS, drag the disk icon from the desktop to the trash or hit ⌘-e. In Windows OS, highlight the disk icon, right-click, and select "eject". It is best practice to "eject" the 702T volume from the computer to maintain file integrity (*see FireWire File Transfer*).

Front Panel Descriptions

All 702T settings can be accessed and monitored through the front panel LCD and navigation buttons. This allows the unit to be placed in a production bag along with field mixers, wireless transmitters, and wireless receivers.



1) **Digital Input LEDs**
Indicates the presence of AES or SPDIF-digital signal on the respective input. When flashing, indicates that digital input is selected but no valid digital word clock signal is present.

2) **Input 1 Gain**
Controls the analog gain (input trim) of the channel 1 input. Normal mic input range is from 25 dB to 70 dB, low gain mic range is from 10 dB to 55 dB, line input range is from –6 dB to 18 dB. For line-level inputs, this control can be defeated for setup-menu-controlled gain. If the LCD display shows "locked" when the control is rotated, gain control of the line-level input is menu-controlled. When inputs are linked as a stereo pair, Input 1 Gain controls the gain of both inputs.

3) **Input 2 Gain**
Controls input 2 gain, as in #2 above. When inputs are linked as a stereo pair, Input 2 Gain adjusts left-to-right balance.

4) **MENU Button**
Used to access all 702T Setup Menu selections. When in menu mode, used to move up through the menu selections. Pressing the HDD and MENU buttons simultaneously brings up the time code jam menu (702T).

5) **LCD Display**
Primary display of the 702T. The LCD is backlit using the LCD backlight control (#15).

6) **Tone Oscillator**
Press to activate the tone oscillator, press and hold for two seconds or longer to latch on, press again to deactivate. Frequency, tone level, and routing are controlled in the Setup Menu. When in the Setup Menu use the TONE key to enter Setup Menu options and select parameters when the check mark appears in the upper right hand corner of the LCD.

7) **Input-to-Track Matrix LEDs**
Blue LEDs indicate inputs (1 and 2) enabled for recording to tracks (A and B). A solid blue LED indicates an input is routed to a track. A flashing LED during "custom" routing mode shows the selected input/track combination.

8) **INPUT Select Button**
Pressing the INPUT button brings up the input muting and routing menu. Hold down the INPUT button and press one of the indicated soft buttons to mute inputs. Pressing the STOP button and the INPUT select button cycles through the four factory preset input-to-track routing combinations plus the custom routing menu. In the custom routing menu any input can be routed to any track. See *Input-to-Track Routing, page 18*.

9) **Level Meter LEDs**
Two 19-segment track level-meters indicate level in dBFS. Metering ballistics are selected in the Setup Menu.

10) **Power Button**
Press and hold to power up the 702T. Press and hold to power down.

11) **Charge LED**
Indicates the charge status of the on-board battery charger. LED flashes when external power is connected and the removable battery is charging; illuminates solid when battery is fully charged.

12) **Power LED**
Indicates the 702T is powered and available for operation. LED flashes when the removable battery or external DC is in a low-voltage condition.

13) **Record Button**
Press to record. The 702T is a record-priority device; pressing this button starts recording and discontinues all other functions, except file operations. Pressing button during recording can set a cue marker or start a new file, as selected in the Setup Menu.

14) **Stop/Pause Button**
Press and hold this key for 150 ms to stop recording. In Record Pause mode the STOP key will pause the recording, pressing it twice will finalize the recording. In playback mode, a single press pauses playback (play-pause), allowing audio scrubbing with the FF and REW keys. Another press of the key enters play-stop mode where the FF and REW keys select files for playback from the current directory. One more press of the key exits playback mode. In the setup menu the stop key is also used to exit from any menu, returning to the main display.

15) **LCD Backlight Button**
Press to toggle LCD and button board backlighting. Hold the button and turn the Rotary Switch to adjust the brightness of LEDs. In menu mode, functions as the soft-button to cancel a selection.

16) **Fast-Forward Button**
Performs fast-forward (FF) scrubbing through a playing sound file when pressed in playback and play-pause mode. Play-pause indicated by flashing A-time on LCD. Fast forward rate increases the longer the button is held. In play-stop mode (indicated by flashing filename on LCD) selects the next file in the record folder (either daily folder or main folder).

17) **Play Button**
Plays the sound file displayed in the LCD. If pressed immediately after recording is stopped, the most recently recorded file is begins playback.

18) **Rewind Button**
Performs reverse (REW) scrubbing through a playing sound file when pressed in playback and play-pause mode. Play-pause indicated by flashing A-time on LCD. Reverse playback rate increases the longer the button is held. In play-stop mode (indicated by flashing filename on LCD) selects the previous file in the record folder (either daily folder or main folder).

19) **HDD (File Viewer) Button**
Press to enter the File Viewer. Pressing simultaneously with the MENU button opens the time code jam menu.

20) **Headphone Output Peak LED**
Indicates overload of the headphone amplifier. When lit, the headphone circuit is overloading. Reduce headphone level.

21) **LIM LED**
Indicates that the microphone input limiters are on. This LED does **not** show input limiting activity (*see descriptor #27, Microphone Input Limiter LEDs*).

22) **Link LED**
Indicates that channels 1 and 2 are linked as a stereo pair. In link mode input 1 potentiometer controls gain, input 2 potentiometer controls left-to-right balance. Inputs can be linked as either a stereo L/R pair or as a a Mid-Side (MS) pair.

23) **Media Ready LEDs**
Indicates storage media is present and available to record; CF (CompactFlash), EX (external FireWire device) [*EX requires 2.0-ready hardware*]. Flashing indicates media problem.

24) **Media Activity LEDs**
Indicates storage media read/write activity. CF (CompactFlash), EX (external FireWire device) [*EX requires 2.0-ready hardware*]. Do not remove power until all media activity LED's are off.

25) **High-Pass Filter LEDs**
Indicates that the high-pass (low-cut) filter is active for the input. High-pass only operates when the input is set to microphone level.

26) **Phantom Power LEDs**
Indicates that phantom power (48 volts) is active for the individual input. Phantom can be applied to microphone or line-level signals (menu-selected).

27) **Microphone Input Limiter LEDs**
Illuminates orange when limiting is occurring on the microphone input. If constantly lit, the microphone input is being hit with too "hot" of a signal. Reduce the input sensitivity until limiting occurs infrequently.

28) **Input Signal Presence LEDs**
Indicates presence of analog or digital signal and its relative level on each of the four inputs.

29) **Input Peak (Overload) LED**
Indicates analog signal is approaching clipping (–3 dBFS) on each of the inputs. Additionally, flashes to indicate that an input is muted.

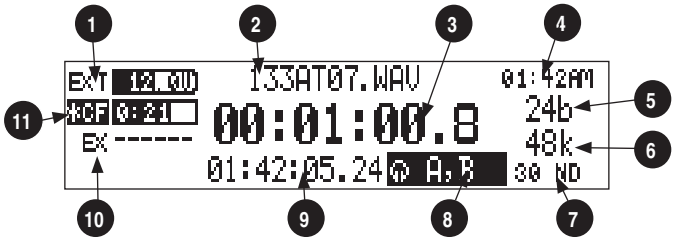
Panel Button Lock

Press and hold the backlight button then the tone button to bring up the Button Lock screen. Button Lock prevents accidental changes to settings or record status. The 702T displays any button lock options enabled.

There are three modes:

- **Unlocked** – all buttons are accessible and operate normally.
- **Non-Transport Lock** – All front panel controls are locked except the Record, Stop, Play, Rewind and Fast Forward.
- **Lock All** – All front panel buttons are locked except the Record button. The Record button is kept active so the user can initiate recording after entering this mode and enter cue markers. To stop recording in this mode, you must disengage the panel lock and hit the stop button.

LCD Display Descriptions



1) **Battery Level Indicator**
Shows the voltage level of either the removable Li-ion battery or external power sources. External power overrides battery power when present. Graphical bar for relative level and numeric indicator for precise voltage measurement.

2) **File Name Display**
Shows the file name actively being recorded or played back. In playback-stop mode, a flashing file name indicates that the fast-forward and rewind buttons can be used to step through files in the current playback folder.

3) **Absolute Time (A-time) Display**
Shows the elapsed time of the file being recorded or played back in hours, minutes, seconds, and tenths. The A-time and the time code display can be exchanged if a large time code display is needed. This display can be set to reverse or flash during recording. Flashes in playback-pause mode.

4) **Time & Date Display**
Alternating display between the set date and time of the 702T. This information is written as the creation and modification date for recorded sound files.

5) **Bit Depth Indicator**
Shows the set record bit depth. In playback, shows the file bit depth.

6) **Sampling Rate Indicator**
Shows the set record sampling rate. In playback shows the file sampling rate.

7) **Time Code Rate**
Shows the set time code frame rate. If a sound file has time code information, the playback frame rate is shown. If external time code is connected and the external rate differs from the rate set internally, the time code rate will flash.

8) **Headphone Source Display**
Indicates the source for headphone output. Sources and selection order are user selectable in the Setup Menu.

9) **Time Code Display**
In stop and record, shows the time code generated or received by the 702T. In play mode, the display shows the played file's time code information (if available). If non-time code files are playing, the display shows dashes. The time code display can be exchanged with the A-time display from a Setup Menu selection.

10) **External Media Space Status**
Bar graph indicates amount of record time remaining on external FireWire media. Numbers show time in hours and minutes based on the presently selected number of record tracks, sample frequency, bit rate, and file type.

11) **CompactFlash Status**
Bar graph indicates amount of record time remaining on the inserted CompactFlash card. Time remaining is shown in hours and minutes based on the presently selected number of record tracks, sampling rate, bit depth, and file type.

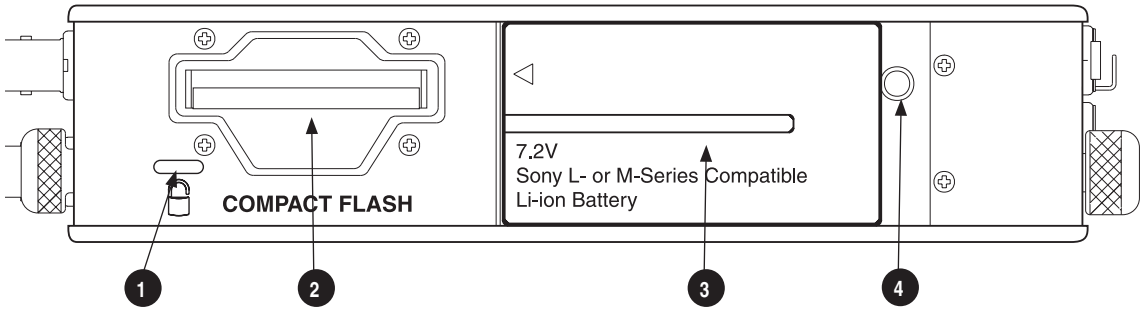
For both media types, an asterisk in front of the media indicates that it is selected for recording. Highlighted volume indicates media selected for record monitoring, playback or file folder display.

12) **Input 1/2 Level**
When input 1 or 2 gain is turned this indicates the gain level in dB for inputs 1 and 2. Gain levels can be selected to always be displayed in the Setup Menu option **LCD: GAIN DISPLAY**. Normal mic input gain range is from 26 dB to 70 dB, low gain mic range is from 10 dB to 50 dB, line input range is from –6 dB to 18 dB. "Locked" will be displayed on the LCD when the pot is turned with digital inputs selected or with line inputs set to menu control.

13) **Cue Marker Display**
In record mode, indicates when cue markers are set. Markers are set by pressing the record button (this option must be selected in Setup Menu). In playback mode, displays cue points numerically as they are reached in a file.

14) **External Digital Clock Indicator**
Indicates that the 702T is locked to a valid external AES or word clock source.

Back Panel Descriptions



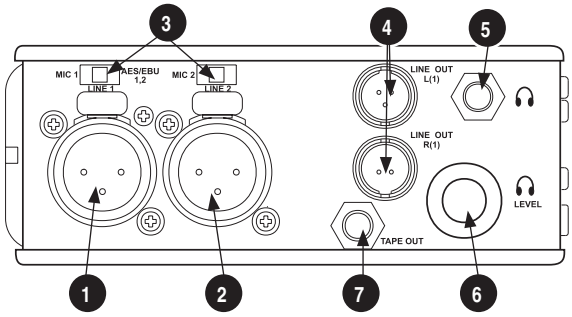
1) **Security Slot**
Compatible with the Kensington® Security Slot specification. Useful for securing the recorder to a fixed object with a compatible computer lock.

2) **CompactFlash Slot**
Accepts CompactFlash cards with the label-side up. Compatible with Type I, Type II, and MicroDrives.

3) **Battery Mount**
Accepts Sony® InfoLithium L- or M-Series removable batteries. Also accepts batteries conforming to this mount. Various capacities, from 1500 mAh to 7000 mAh are available.

4) **Battery Release Pin**
Push down the pin with a long skinny object such as a key, screwdriver, or a pen. With the pin pushed in, slide the L- or M-Series battery to the right to release the battery

Left Panel Connectors and Controls



1) **XLR Input 1/AES3 Input 1&2**
Dual function input connection. Input type set with switch above. Active-balanced analog microphone- or line-level input for input 1. Transformer-balanced two-channel AES3 input (1 and 2).

2) **XLR Input 2**
Active-balanced analog microphone- or line-level input for input 2.

3) **Mic-Line Input Switch**
Selects the input level and mode of the associated XLR input connector. Input 1 also can be selected for AES3 input.

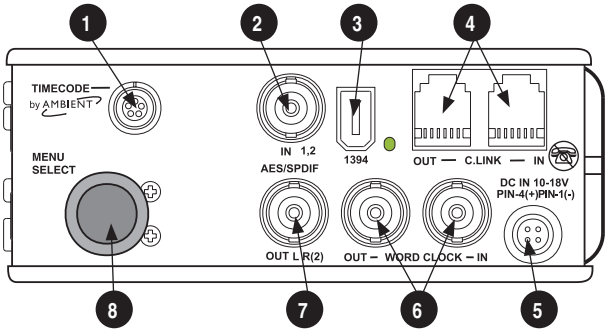
4) **TA3 Master (L/R) Analog Outputs**
Active-balanced, line-level analog L/R outputs for the Master Output Bus. Program source and attenuation level are user selectable. Pin-1 ground, pin-2 (+), pin-3 (–).

5) **Headphone Output**
3.5 mm TRS stereo headphone connector. Can drive headphones from 8 to 1000 ohm impedances to very high levels. Tip-left, ring-right, sleeve-ground.

6) **Headphone Level**
Adjusts the headphone output level. NOTE: the 702T is capable of producing ear-damaging levels in headphones.

7) **Tape Output**
Unbalanced tape (–10 dBv nominal) output on 3.5 mm TRS stereo connector. Signal source is identical to the Master Output Bus. Tip-left, ring-right, sleeve-ground.

Right Panel Connectors and Controls



1) **Time Code Multi-Pin**
Time code input and output on 5-pin LEMO® connector.

2) **AES3id Input 1/2**
Unbalanced digital input accepts two channel AES3id (or S/PDIF) on BNC connectors. Supports sample rates up to 200 kHz.

3) **FireWire (IEEE-1394) Port**
Connection to a computer (Mac OS, Windows 2k/XP, Vista, Linux) to access the CompactFlash volume as a mass storage devices. Also used to attach external FAT32-formatted FireWire drives to the 702T for direct recording and copying.

4) **C. Link In/Out**
RS-232 protocol interface on 6-pin modular ("RJ-12") connector for linking multiple 7-Series recorders together. Word clock, machine transport, and time code are carried on the C. Link connector. Additionally, C. Link accessories connect through this connector.

5) **External DC In**
Accepts power sources of 10–18 volts DC for unit powering and removable Li-ion battery charging. The Hirose 4-pin connector is wired pin-1 negative (–), pin-4 positive (+). Pin-2 (–) and pin-3 (+) are used to charge the removable Li-ion battery. DC ground at both pins-1 and 2 is at the same potential as chassis and signal ground.

6) **Word Clock Input and Out**
Provides clock input and output for the 702T. Word input accepts sampling rates from 32 kHz to 192 kHz. Word clock output is the rate that box is running. There is no sample rate conversion onboard the 702T.

7) **AES3id Master Output Bus**
Unbalanced digital output, two-channel, for the Master Output Bus. Signal source is menu-selected and is identical to the Analog Master Output Bus signal.

8) **Rotary Switch**
In record and playback modes, selects the headphone monitor source; push action is user selectable. When in the Setup Menu, the Rotary Switch moves between menu selections; push to select or enter data.

Input Setup and Control

The 702T has two inputs and two record tracks. Inputs are selectable between analog or digital sources. Analog inputs are connected with the balanced XLR connectors; digital inputs can be connected to either XLR Input 1 (AES3) or the BNC input (AES3id).

Input Source Selection

Input types are selected in pairs. Each input pair accepts analog or digital audio. The XLR input signal is selected with slide switch above the connector.

Manually selecting the audio source is used to force the inputs to analog while using an AES3 or AES3id input to lock the 702T to an external sample rate.

Digital sources connected to AES3id BNC inputs override analog signals on the corresponding XLR input. The BNC input signal type is set in the menu settings **INPUT 1, 2: SOURCE**. For most situations the appropriate setting is auto select—the 702T will choose the input type based on signal present.

The 702T is capable of off-speed sample rates when clocked from either external digital inputs or the word clock input.

Input sources can be set to "disabled (power save)". This option shuts down all circuitry associated with the inputs to reduce power draw and extend battery runtime during playback. When an input pair is disabled, the digital input LEDs associated with the pair will flash.

Analog Inputs

Analog inputs 1 and 2, on XLR connectors, are the primary connections into the recorder. These inputs accept balanced or unbalanced mic- or line-level inputs. When at mic-level, gain is controlled by the front panel potentiometers. Gain for the line level inputs can be controlled by the front panel potentiometers or menu settings. Line input gain is controlled in 0.1 dB steps.

A digital input present on the BNC inputs will override an analog signal present on the XLR inputs unless the input source is set to analog in the setup menu.

In the setup menu, the following functions can be controlled for analog inputs 1 and 2:

Phantom Power

Phantom power (48 volts) can be activated for inputs 1 and 2. When active, phantom is indicated by front panel LEDs (48V).

Phantom power is available for both mic- and line-level inputs. Using line-level inputs with microphones is useful in high SPL environments such as concert recording. Make certain to turn off phantom power with line level output devices susceptible to damage from DC.

Shortcut: To toggle phantom power without entering the menus, press and hold the tone key then press the menu key for channel 1. Channel 2 phantom can be toggled by pressing the tone key then pressing the HDD key. If the inputs are in line level mode, phantom power will not activate from the shortcut keys and must be activated from the menus. Phantom power is linked when the inputs are linked. *(See Input Linking)*

Input Limiters (mic-level only)

Microphone inputs 1 and 2 each have a limiter circuit designed to prevent input overload. In normal operation, with proper gain settings, the limiters should rarely engage. When activated, these

limiters will prevent unusually high input signal levels from clipping the analog input stage of the preamp. The front panel LIM LED (LIM) shows that the limiter is engaged. Limiter activity is indicated by additional front panel LEDs, one for each input channel (LIM). The input limiters are active only with mic-level inputs. The limiters are engaged by (factory) default.

When limiters are engaged, audio on channels 1 and 2 is limited to –6 dBFS.

Microphone Level Control

Microphone gain is controlled by the front panel recessed knobs. The gain control adjusts an analog gain stage and functions similarly to the input trim on a mixing console or stand-alone microphone preamplifier. Gain is controllable over two ranges, normal and low.

Gain Range (microphone-level only)

The microphone inputs operate in four gain ranges, **NORMAL**, **NORMAL FADES TO OFF**, **LOW**, and **LOW FADES TO OFF**. The **NORMAL** range controls input gain from 24.3 dB to 67.4 dB of gain. The **LOW** range controls input gain from 9.3 dB to 52.4 dB. The **LOW** ranges are useful for high SPL recording environments. The fade to off options allow for fader-like control of your gain. **NORMAL FADES TO OFF** provides a gain range of off or 0 to 67.4 dB and **LOW FADES TO OFF** provides a gain range of off or 0 to 52.4 dB.

High-Pass Filters (microphone-level only)

The high pass filters on the microphone inputs use a combination of analog and digital filters to reduce sensitivity to low frequency signals. When the high-pass is engaged on an input, its front-panel LED illuminates to indicate it is active ( ). The first pole of the high-pass circuit is an analog filter at 40 Hz, 6 dB per octave and is part of the microphone preamplifier circuit. Additional poles of high-pass filtering are done in DSP.

Several frequency and slope combinations are selectable, including corner frequencies of 40, 80, 160, or 240 Hz, and filter slopes of 12 dB, 18 dB, or 24 dB per octave. The high-pass is selected for each input independently.

Shortcut: The filters can be toggled with a two-key combination. Press and hold the LCD backlight key and press the MENU menu key for channel 1 high-pass. Press and hold the LCD backlight key and press the HDD key to toggle channel 2 high-pass. The high pass filters are linked when the inputs are linked. *(See Input Linking)*

Line-Level Gain Control

When in line-level position, the gain for inputs 1 and 2 is controlled by the front panel recessed potentiometers or by a menu sensitivity setting. When set for front panel control in the user menu, **LINE INPUT 1: GAIN** and **LINE INPUT 2: GAIN** controls in the user menu are lined out and not accessible.

Input Linking (Stereo or MS Decoding)

Analog inputs 1 and 2 can be linked as a stereo pair. When linked, the channel 1 front panel potentiometer controls the signal level of both inputs, and the channel 2 pot controls the left-to-right balance of the pair. When the inputs are linked, their peak limiters are linked, as well.

When set to link as an MS pair, the inputs are decoded as left/right stereo, where the gain and balance for the pair work the same as stereo linking above. Input 1 is for Mid signal, input 2 for Side signal.

When the inputs are linked, phantom power and the high pass filters also act as linked pairs. Engagging and disengaging phantom power or the high pass filters on input one will force the same func-

tion upon input two. Engaging or disengaging phantom power or the high pass filter on input two causes no effect on input one.

If MS stereo linking is selected for inputs, program sent to tracks and headphones will be L/R stereo program. To record discrete M and S signals, do not link for MS, but monitor the MS signal in headphones.

Things to consider when Linking Input 1,2 as MS:

- Digital Inputs cannot be linked as an MS pair.
- If linking Line Inputs as an MS pair, the Setup Menu option **`LINE INPUT 1,2: GAIN CTRL`** must be set to Use Front Panel Knobs.

Digital Input – AES3

The 702T accepts AES3 (AES/EBU) balanced digital at the input 1 XLR connector. Digital input is two-channel—AES3 signals on XLR-1 appear at inputs 1 and 2. To use the AES3 input, the input mode-select switch must be set to AES/EBU. There is no level control for AES inputs.

The front panel digital input LEDs illuminate when digital signal is selected as input. If the LED is flashing, digital input is selected but a no valid digital clock is being received.

Digital Input – AES3id (S/PDIF)

The 702T accepts AES3id and S/PDIF unbalanced digital signals on the BNC connector. The 702T will auto detect the type of digital signal and adjust accordingly. Like AES3 signals, this is two channel input. There is no level control for AES3id inputs.

AES3id inputs override analog signals present at the XLR inputs. To use analog sources while using the AES3id signal as a digital clock source, select analog in the input source menu selection.

When a digital signal is present, the 702T locks its sample rate to its source frequency. This lock is indicated by a highlighted block **L** on the main LCD display to the right of the bit depth and sample rate indicators. Recording bit depth is independent of the external digital source.

When locking the 702T to an external digital signal, be certain the source is stable. Loss of digital signal will cause the 702T to revert to its internally set sample rate, even while recording. The portion of the file recorded after the loss of signal may not play back properly. Once recording has begun, unused digital inputs are muted, digital signals that appear on them after the record button has been pressed will not be recorded or affect the sample rate of the 702T.

The 702T clocks itself to the first digital signal presented to it. If the 702T detects a digital signal on the BNC inputs and locks to that signal, a digital signal applied to the XLR input will be ignored until the first digital signal is removed.

Signal Presence and Peak Indicator

The signal presence and peak indicators show audio activity before input-to-track routing. Input signal presence LED's illuminate when a –50 dBFS or greater signal is present. Input signal peak LEDs illuminate when signal levels reach –3 dBFS or greater.

Input Delay

A digital delay is selectable on each channel of the 702T. Delay time per input is selectable in tenths of a millisecond (0.1 msec) steps. The Rotary Switch and menu arrows are accelerated. The more you press or spin, the faster the time setting will increase or decrease. Delay is not set until the Rotary

Switch is pressed or or the check mark is selected. The amount of delay available is dependent on the sampling frequency in use.

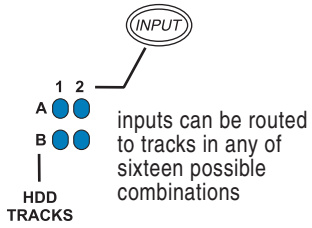
Sample Frequency	Maximum Amount of Delay Available (per input)
32, 44.1, 47.952, 48, 48.048 kHz	30 mS
88.2, 96, 96.096 kHz	15 mS
176.4, 192 kHz	7.5 mS

Input delay can be useful for time aligning input signals from differing sources. For example, digital wireless mics that have a processing delay in their outputs. In addition, all digital conversion stages have delay.

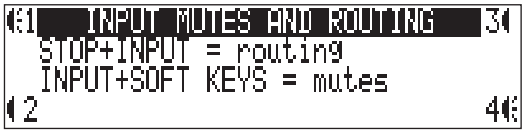
Input-to-Track Routing

The 702T uses a flexible routing scheme to assign inputs and tracks for recording. The input matrix allows any input to be routed to any recording track. Multiple inputs can be routed to a single track to create mono-mixed recordings.

The 2-by-2 blue LED matrix makes it easy to view the set routing. A solid blue LED indicates an input is assigned to a record track.



Pressing the INPUT key brings up the following menu.

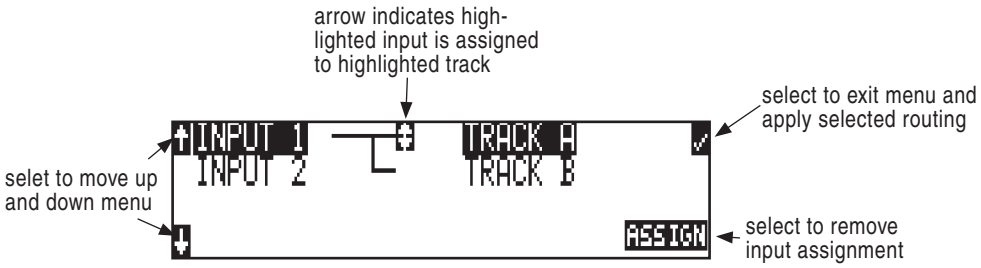


Routing

Hold down the STOP button then press the INPUT button to cycle through the four preset input-to-track routing combinations. These presets are factory set and cannot be changed. The last three preset selections are **CUSTOM ROUTE** options. Press the **EDIT** soft button to enter the custom routing menu. Custom routing allows any input to be assigned to any record track. In the menu, highlighted input and track combination are displayed in white text. The two inputs are shown on the left; the two record tracks are shown on the right.

To assign custom input routings:

1. Press and hold the Stop button, then press the INPUT button successively until **INPUT ROUTING** is displayed in the LCD display.
2. Use either the soft buttons for up and down or the Rotary switch to select **CUSTOM ROUTING.**Press the **EDIT** soft button ( ).

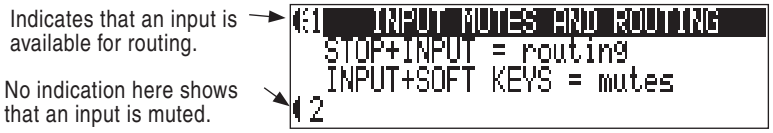

arrow indicates high-lighted input is assigned to highlighted track
select to exit menu and apply selected routing
selet to move up and down menu
INPUT 1
INPUT 2
TRACK A
TRACK B
ASSIGN
select to remove input assignment

3. Using either the Rotary Switch or the up and down arrows, navigate to desired input-to-track combinations.
4. When a chosen pairing is highlighted press either the **ASSIGN** soft button or the Rotary Switch to assign the combination. Assigned tracks are noted on the screen by the addition of an arrow pointing to the record track. The LED routing matrix will also show a flashing blue LED for the currently selected input-to-track combination.
5. Once a track is assigned move to the next input-to-track combination desired.
6. To remove an input-to-track combination assignment, navigate that combination and press the **UNASSIGN** soft button.
7. Exit and complete the assignment by pressing the check mark soft button.

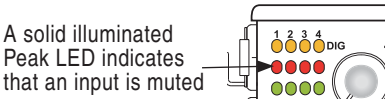
The input routing menu will always exit to the main screen whether entered from the INPUT button or the Setup Menu.

Selective Input Muting

When the INPUT button is pressed, individual input muting is available. This feature can be used to quickly mute microphones while maintaining their respective track assignments.


Indicates that an input is available for routing.
No indication here shows that an input is muted.
1 INPUT MUTES AND ROUTING
STOP+INPUT = routing
INPUT+SOFT KEYS = mutes
2

A solidly lit input Peak LED indicates that an input is muted.



Mono- and polyphonic files behave differently when selective muting is applied. When monophonic files are selected, files from tracks A and B are named with the suffix "_1 and _2" respectively. If, for instance, track A is muted but trackB is still selected, the resulting file will be named with the suffix "_2" and track A will not be recorded, saving storage space.

When polyphonic file type is selected in the same scenario as above with track A muted, the resulting data file will be a two-track file with track A being a blank track. Blank tracks in polyphonic files take up the same amount of storage space as tracks that are assigned.

Sampling Rate and Bit Depth

When recording the 702T generates uncompressed PCM audio WAV files in the Broadcast Wave File format at the user-selected sampling rate and bit depth. The 702T LCD calculates available recording time based on the sampling rate, bit depth, number of tracks armed for recording and the storage media's available capacity. See the *Calculating Recording Time* later in this guide to estimate record time.

Sampling Rate

When a sampling rate is selected for recording, all tracks are recorded at the selected sampling rate. Sampling rates are selected among common rates from 32 kHz to 192 kHz. Additionally, non-standard sampling rates can be applied when the 702T is word clocked from an external source (clock sources between 32 kHz and 192 kHz). When recording off-speed sampling rates files will be stamped with the rate closest to an internally generated frequency.

Relationship Between Sampling Frequency and Audio Bandwidth

The sampling frequency is expressed in samples per second (in hertz) and defines the number of times in a second that the analog audio signal has been measured. Sampling frequency determines the audio bandwidth, or frequency response, that can be represented by the digital signal. A quick estimate of the maximum bandwidth capable of being represented at a given sampling rate is maximum analog frequency = sampling frequency/2. Higher sampling frequencies allow for greater audio bandwidth.

The 702T generates the following sampling rates:

- 32 kHz
- 44.1 kHz
- 47.952 kHz
- 47.952kF - file stamped at 48 kHz
- 48 kHz
- 48.048 kHz
- 48.048kF -file stamped at 48 kHz
- 88.2 kHz
- 96 kHz
- 96.096 kHz
- 96.096kF - file stamped at 96 kHz
- 176.4 kHz
- 192 kHz

See Time Code section for more information about the 48.048F, 47.952F, and 96.096F rates.

Bit Depths

The 702T records at bit depths of either 16 or 24 bit. 24 bit recording provides greater dynamic range and addition headroom for signal peaks relative to 16 bit recordings. 24 bit recording (versus 16 bit) is a significant benefit for field production audio tracks.

Bit Depth = Available Dynamic Range

Bit depth defines the digital "word length" used to represent a given sample. Bit depth correlates to the maximum dynamic range that can be represented by the digital signal. Larger bit depths accommodate more dynamic range. A quick estimate of maximum dynamic range capable of being represented by a given word length is dynamic range ~= no. of bits x 6 dB. Bit depth is an exponential measure (exponent of 2), so as bit depth increases, the amount of data it represents increases exponentially. The majority of field recording is done with 16-bit audio, therefore, each sample is rep-

resented by a digital word of 2^16 (65,536) possible values. 24-bit audio has a word length of 2^24 (16.7 million) possible values per sample.

The 702T has 24 bit analog-to-digital converters. To obtain 16 bit recording the 702T can be set to dither the 24 bit digital signals output from the analog-to-digital converter to 16 bit. The 702T uses a proprietary pseudo-random dither routine for accurate bit rate reduction. Dither can be defeated in the user menu. Without dither, 24 bit audio is truncated to 16 bit, meaning the least significant 8 bits are discarded.

Once a file is recorded its sampling rate and bit depth can not be changed in the recorder. The 702T does not perform sample rate conversion or bit depth changes. File conversion must be done in another environment, such as an audio workstation. Alternatively, a real-time analog transfer is often performed instead of sample rate conversion.

Word Clock

Stable word clock is fundamental to a high quality digital audio signal. The 702T uses a highly-stable crystal to generate its internal word clock. The 702T can clock external devices from its word clock and accept external clock sources for recording.

The 702T ignores external clock, both AES and word clock, during playback.

Clock Master

When sending digital audio to several devices, one unit is designated as the word clock master and the others as slaves. Generally, the device with the analog-to-digital converter is designated as the word clock master.

The 702T can function as an analog-to-digital converter and can be used as a master word clock source. Slaved devices will derive their word clock timing from either their digital audio inputs, S/PDIF or AES/EBU, or through their word clock input connection. As a word clock master the 702T generates word clock whether or not audio is sent.

Clock Slave

When using an external digital preamplifier connected to the 702T inputs, the recorder can derive its clock signal from the AES (S/PDIF) stream (it will slave to the external device), or the external device can be slaved from the 702T (if the external device has word clock input or accepts clock from the 702T's digital output). For example, if you are using a wireless receiver with a digital output, it may not have an external word clock input, and must be the word clock master.

If digital audio is connected to the 702T from more than one digital device, you must word clock the sources to the same clock, otherwise variations between the sources will render their signals unusable.

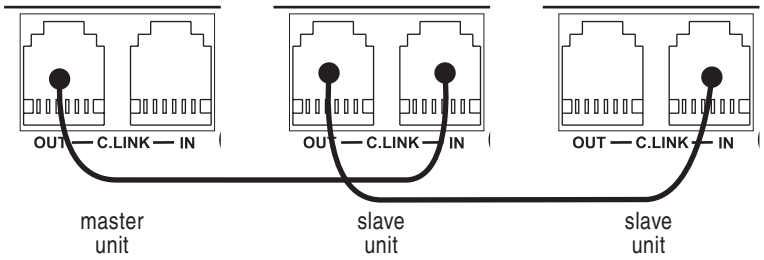
If the 702T is slaved to external word clock, be certain that the source is stable. Loss of the word clock signal during recording can cause the 702T to revert back to its internally set sampling frequency. If this occurs, the portion of the file recorded after the loss of word clock may not play back at the proper speed. For reliability, set the 702T to the same sample frequency as the word clock source. Loss of the word clock signal in this case will likely cause a glitch in the file, but the file may still be usable.

C. Link – Multi-Unit Linking

The proprietary C. Link (control link) connection allows multiple 702T, 702T, 722, and 744T recorders to be connected and clocked together. The C. Link also enables the CL-1 Remote Control and Keyboard interface to control the 702T with an attached keyboard or via switch closures.

When linked, recorders have a master/slave relationship. The master recorder and the slave unit will share sample accurate start and stop record times. Multiple units can be daisy-chained together to record many tracks. The C. Link protocol links carries the following data:

- word clock
- time code information (702T and 744T only)
- RS-232 machine transport data



To link units:

1. Connect multiple units as shown in the illustration.
2. Set all linked recorders to the same sample rate, bit depth, file format, and time code frame rate (for 702T and 744T units used). This will ensure that all files generated are compatible.
3. Set scene and take numbers on all linked recorders to the same starting file name. There is no file name synchronization with multiple unit linking.

When linked, record start and stop on slave units will not affect units "above" it in the linked chain. This makes it possible for units to get out of synchronization if a unit other than the master is set to record or stop. Using the master unit will assure that all machines begin and end recording together.

Master/Slave relationships between C.Linked recorders is established immediately after the C.Link Out to C.Link In connection is made. To reverse the Master/Slave relationship, power down all recorders, establish the new Master/Slave relationships by reconnecting the C.Link Out to C.Link In connectors in the desired sequence, then power on all units in order of their Master/Slave relationships

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The C. Link jack is a proprietary RS-232 port. Under no circumstances should analog or digital telephone lines be connected to either jack. Serious damage may result.

Outputs – Analog and Digital

The 702T has two independent output buses, the Analog Output Bus (Bus 1) and the Digital Output Bus (Bus 2). Each side (left and right) of the two-channel buses are assigned audio sources independently, allowing the 702T to feed multiple audio devices with unique program content.

The chart below shows the audio sources available for the analog and digital output buses. The audio source for each output is selected in the Setup Menu.

Available Output Sources	Description
Input **1** Input **2**	Inputs are assignable for each channel of the output bus. *When inputs are selected as the source for the outputs, the state of recording or playback activity has no effect on the output signal. This allow uninterrupted input audio at the output.*
Track **A** Track **B**	Track assignments and playback audio.
Input **1,2**	Multiple inputs are summed with these selections.
Track **A,B**	Multiple track assignments are summed with these selections.

Master Output Bus

Audio signals routed to the Analog Output Bus (Bus 1) are sent to three output connections:

- analog line out, TA3 x 2, two-channel
- analog tape out, 3.5 mm TRS, two-channel

Analog Line Out L, R

The analog line outputs are active-balanced line-level signals on Switchcraft TA3M locking connectors. The output level is a nominally 0 dBu at –20 dBFS. The output level can be attenuated from the Setup Menu by up to 40 dB in 1 dB increments. Both left and right outputs are attenuated equally.

Analog Tape Output

The tape output connection is stereo, unbalanced consumer output level (–10 dBV) on a TRS 3.5 mm connector. Output attenuation affects this output level.

Digital Output Bus

Just as with the Analog Output Bus, the Digital Output Bus (Bus 2) can be assigned signal sources from inputs or tracks. Sources assigned to the Digital Output Bus are exclusive and do not affect the assignments to the Analog Output Bus or headphone assignments. The same signal sources available for the Analog Output Bus are available for Digital Output Bus (see chart above).

The Digital Output Bus appears solely on the AES3id BNC output connector. The unbalanced AES3id output is directly compatible with most S/PDIF inputs.

The format for the AES3id output is selectable between professional AES and SPDIF. In either case the SCMS bit is not set.

The maximum output level is 0 dBFS and can be attenuated in the Setup Menu in 1 dB increments by 40 dB.

Headphone Output

The 702T headphone output is a flexible tool for monitoring audio in the field. The 702T allows the user to monitor inputs, tracks, and post-record tracks in a number of combinations. MS stereo monitoring is also available in headphones.

The headphone output is independent of the Master Output Bus and the Output Bus 2—audio sources can be routed to headphones independent of routing assignments to output buses.

The 702T is capable of driving headphones to extremely high sound pressure levels. Hearing experts advise against exposure to high sound pressure levels for extended periods.

Selecting Headphone Sources

The headphone source display on the main LCD screen ( ) shows the audio sources sent to headphones. The 702T comes from the factory with several preset headphone audio source selections available on the Rotary Switch. These selections include inputs, tracks and track monitors. Turn the Rotary Switch to select among the available headphone monitoring sources.

Track Monitoring While Recording (Confidence Monitoring)

The 702T can monitor actual recorded audio written to the Compact Flash card during recording. This is commonly referred to as "confidence monitoring". To monitor recorded tracks, during recording select one of the track monitor modes. Because of the record buffering topology of the 702T, a delay of up to 12 seconds can be expected before recorded audio appears at the output. The 702T will play back recorded audio from the media highlighted on the LCD panel (see *File Management and Copying* for more information on selecting and highlighting storage medium).

Setting Headphone Source Options

In addition to the 5 preset headphone routings, a total of 20 available "slots" can be filled in a user defined order. Headphone monitoring sources are selected from combinations of inputs, tracks, and post-record tracks, including stereo and MS decoding. The order of headphone selections is user-selectable. Available sources for headphone monitoring include:

HP Sources	Description
Inputs **1,2**	Stereo monitoring of input pairs. Input 1 is assigned to left headphone output; input 2 is assigned to right headphone output.
Tracks **A,B**	Stereo monitoring of track pairs. Track 1 is assigned to left headphone output; track 2 is assigned to right headphone output. Upon playback, will play as track monitor.
Monitor **A,B**	Stereo monitoring of playback (post-record) track pairs. Track 1 is assigned to left headphone output; track 2 is assigned to right headphone output. *When using the recorded track monitor selection, there is a sample rate dependent delay in the signal. At 48 kHz sampling, the delay is approximately 12 seconds. This delay is due to the record buffering topology. Audio can not be monitored until it has left the record buffer and written to the recording media.*
Input **1, 1** Input **2, 2**	Solo monitoring of selected input. This signal is sent to both sides of the headphones.
Track **A, A** Track **B, B**	Solo monitoring of selected track. This signal is sent to both sides of the headphones. Upon playback, will play as track monitor.
Monitor **A, A** Monitor **B, B**	Solo monitoring of playback (post-record) track. Highlighted media is source of monitor program. This signal is sent to both sides of the headphones. When not in playback, headphones have no program.
Inputs **1, 2 (MS)**	Stereo monitoring of discrete M (mid) and S (side) input pairs. Highlighted media is source of monitor program.

HP Sources	Description
Tracks **A, B (MS)**	Stereo monitoring of discrete M (mid) and S (side) track pairs. Highlighted media is source of monitor program. Upon playback will function as MS track monitor.
Monitor **A,B (MS)**	Stereo monitoring of playback (post-record) discrete M (mid) and S (side) track pairs. Highlighted media is source of monitor program. When not in playback, headphones have no program.
Inputs **1+2, 1+2**	Summed inputs appear in each ear for summed mono monitoring of both inputs.
Tracks **A+B, A+B**	Summed tracks appear in each ear for summed mono monitoring of both tracks.

When tracks (A or B) are monitored in headphones, audio assigned to the tracks is heard in headphones during recording. During playback the recorded track audio is heard in headphones.

To set the available headphone source options for headphone monitoring enter **HP: MONITOR** from the Setup Menu. In the Monitor Modes menu you will immediately be in slot-1. Turn the Rotary Switch to select the source you wish to appear first in your Headphone monitor list. Once the chosen source appears, press the Rotary Switch or the soft button **ENTER** (tone) button to move to the next slot. Continue down the list to select the source for each slot in the list. Once all sources have been chosen, press (done). This will exit the headphone monitor mode setup. You can exit the selection process by pressing the stop or cancel (backlight) button at any time.

If **DONE** *is pressed in the first headphone slot, the 702T will select a single option (Tracks A, B) for headphone monitoring. The 10 factory presets will be erased.*

MS Stereo Monitoring

The MS stereo mode decodes discrete Mid-Side stereo signals to a left/right stereo signal for monitoring purposes. This allows for a proper stereo signal to be monitored in the field while discrete M and S signals are recorded for later post production. For the MS decoder to operate properly, the Mid signal is connected to input 1 and the Side signal is connected to input 2. The amount of stereo "spread" is fixed to a 50/50 percentage from Mid to Side signal.

If MS is selected for input linking, do not use MS stereo monitoring. This would result in two MS decoders being inserted in the signal path. The resulting audio in the headphones would be the discrete M and S signals!

Rotary Switch Behavior

The action of the Rotary Switch during recording and playback is set from among the three available options:

- **Disabled**: pressing the Rotary Switch has no effect.
- **Selects Favorite Mode**: places the headphone source into the mode selected in the HP Favorite menu.
- **Playback/Monitor Drive Select**: pushing the Rotary Switch toggles between CompactFlash, and external hard drives for playback and monitoring while recording.

Headphone Favorite Selection

If "**SELECTS FAVORITE MODE**" is selected from the choices above, pushing the Rotary Switch selects the assigned "Headphone Favorite" source. This feature is helpful to quickly return to a selected headphone monitoring selection while recording or playing. One of the available headphone selection can be selected as the headphone favorite.

Headphone Playback Mode

The user may select a headphone source for automatic selection upon playback. All headphone source selections are available for Headphone Playback Mode, as well as "No Change", which leaves the headphone source set to the currently selected mode. Headphone Playback Mode is controlled in the Setup Menu.

Headphone Warning Tones

The 702T can generate an audible beep, or warning "bell", in the headphones when an error has occurred. The specific error will be reported on the LCD. The output level of the warning bell is menu-selectable from off to –12 dBFS in the Setup Menu.

Recording Start and Stop Bells

If the Setup Menu option **HP: RECORD/STOP BELL** is enabled, the 702T will generate beeps to alert the user of the recorder's current status. These beeps are only sent to the headphone monitor, these beeps are not present in the recordings or at the analog outputs.

7-Series Status	HP: Bell
Recording	One 440 Hz beep
Paused (if using Rec: Record Pause)	One 220 Hz beep
Stopped	Two 220 Hz beeps

Low Battery Warning

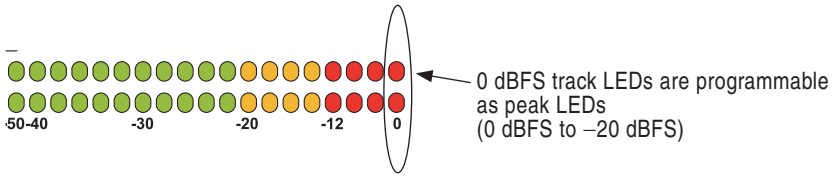
When either the attached battery or external power supply voltage reaches their low warning levels (6.5 V for the attached Li-ion, 11.0 V or user-selectable for external) warning tones are played in headphones. The warning tone is a three pop note of 880 Hz every 20 seconds.

If all warning tones are turned off, no tones are sent to headphones, including low battery warning tones.

Metering and Display

The 702T features a 38-segment LED (2 x 19) signal level meter. The DSP-controlled meter provides a selection of ballistics and lighting intensities. In addition, peak indicators on input channels show overload activity.

Output Meter

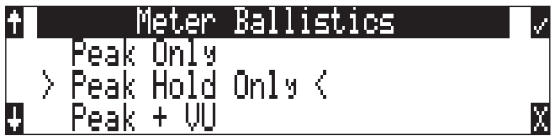


The meter uses energy efficient LEDs viewable in full sunlight. The 702T output meter is unaffected by shock or extremes in temperature and humidity. Meter ballistics are Setup Menu selectable among VU, Peak, Peak-Hold, VU + Peak and VU + PeakHold.

The meter uses a compound metering scale which increases meter resolution in the most important part of the scale. From –50 to –40 dBFS, each LED segment equals approximately 10 dB. From –40 to –12 dBFS, each segment equals 2 dB. From –12 to 0 dBFS each segment equals 4 dB.

Meter Ballistics

The output meter can be set to display any of five types of meter ballistics: VU, Peak, Peak-hold, a combination of VU and Peak, and a combination of VU with Peak-hold. The meter ballistics are selected in the Setup Menu.



VU - (Volume Units)

Ballistics correspond closely to how the human ear perceives loudness and provides a good visual indication of how loud a signal will be. In VU mode, the attack and decay of the meter signal is 300 mS. While giving a very good visual indication of perceived loudness, VU meters gives poor information on actual signal peaks and are virtually useless for tracking to the 702T. In VU mode, the front panel meter labeling is in volume units.

Peak

Peak-reading ballistics correspond to actual signal maximums, but don't necessarily correspond to perceived signal loudness. A peak meter has a near-instantaneous attack to display maximum signal amplitude and a slow decay to allow the user to see them. Peak metering is essential for digital recording, since signal overload can cause immediate distortion. The peak meters front panel markings are calibrated in dBFS, decibels relative to full-scale digital signal.

Peak Hold

Essentially the same as Peak metering where the peak level indication will hold for the peak level indication for several seconds. Peak-hold indicators are useful for metering in applications when an overload condition is unacceptable.

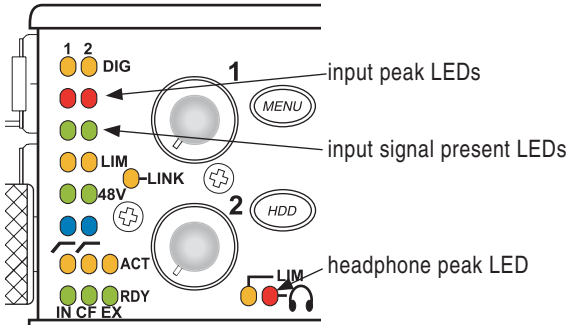
Peak/VU

The meter can simultaneously display VU and Peak level information. In this mode the perceived loudness (VU) is displayed on a bar graph, and the Peak signal on a dot above the VU. With this combination the user gets the best of both VU and Peak metering by seeing both the "loudness" of the signal and the peaks at the same time. Peak/VU is the factory default.

Peak Hold/VU

Similar to VU/Peak mode, this mode holds the peak level indication for several seconds before releasing. Peak Hold indicators are useful for metering in applications when an overload condition is unacceptable.

Peak LEDs



In addition to the main LED output meter, peak LEDs show input peaks, track peaks, and headphone peaks.

Input Peak

The 702T has a peak LED associated with each input. These LEDs illuminate when input signal reaches –3 dBFS. There is no user-adjustment to the Input Peak LEDs. These LED's also function as indicators of input mute activity (*see Input-to-Track Routing*).

Track Peak

The 0 dBFS LED on each track can also function as a track peak indicator. The user can select a signal threshold above which the 0 dB LED will flash.

Headphone Peak

Like the channel peak LEDs, the headphone circuit has an indicator for peak overload. This LED is useful, since headphones can often overload before the recorder overloads. Monitoring without a visual indication of headphone clipping may mislead the operator into thinking that the output or return tracks are distorting.

Tone Oscillator

The tone oscillator can be used as an aid to lining up levels. Both tone level and frequency are user selectable. Reference level is adjustable over a range of –40 to 0 dBFS in the Setup Menu option **TONE: LEVEL**. The tone frequency is adjustable from 100 to 10,000 Hz in increments of 10 Hz from the Setup Menu option **TONE: FREQUENCY**. Standard tone levels vary according to the practices and needs of production and post-production, but are generally in the –20 to –12 dBFS range.

The tone oscillator is activated by pressing the TONE key. Press and hold for two seconds to latch on, pressing again will deactivate the tone signal. Tone is routed where specified in the Setup Menu option **TONE: MODE**. Routing choices include: Outputs only, Outputs and Tracks, Tracks only, or no tone routing (disabled). When routed to Tracks, all selected record tracks will receive the tone signal. Changes to tone oscillator settings made while tone is latched on do not take affect until tone is turned off.

To record tone at the head of a take, activate the tone signal then press the REC key. From the factory, subsequent presses of the TONE key are locked out to prevent tone from being inadvertently recorded. Tone can be activated while recording by following these steps.

1. Enter the Setup Menu option **FILE: MARKER MODE** and set it to disabled.
2. Press the REC key to begin the recording.
3. To record tone, Press and hold down the REC key then press the TONE key. To latch tone, press and hold the Tone key for 2 seconds, press again to release. Once tone is generated the REC key can be released.

The tone oscillator can be activated anytime during recording by setting the **TONE: RECORD LOCK** feature in the Setup Menu. Press the Tone key anytime to generate a tone signal. Please note that when enabled, any slight press of the tone key will generate tone and **override** any program material where tone has been routed to, including record tracks.

LCD Contrast & Backlight, LED Brightness

LCD contrast is setup menu controlled. From the factory the contrast is set to 50%, suitable for most viewing conditions. Contrast can be increased or decreased.

The front panel key toggles the LCD and key backlight. Backlighting is suitable in low or no ambient light situations.

LED brightness is continuously adjustable from low to high. Hold down the key, then turn the Rotary Controller to change brightness levels. The brightness of all LED's is adjusted. In stealth mode (Setup Menu selected) the LEDs are toggled on and off with the LCD backlight key.

LCD Gain Display

By default, the 702T displays the set Bit Depth and Sampling Rate in the right-hand side of the Main LCD Display. The gain level for inputs 1 and 2 temporarily override the Bit Depth and Sampling Rate display while the input gain pots are in use. The LCD display can be set to always display gain by selecting Gain Only in the Setup Menu option **LCD: GAIN DISPLAY**.

Record Indication

The position of the A-time numbers and time code numbers can be exchanged in the Setup Menu. When **BIG TIME CODE** is selected in the menu the time code is displayed in the main numeric display. If time code is turned off A-time is shown as large numbers, even with **BIG TIME CODE** set.

To provide for additional visual indication that recording is in process the big numerals can be set to reverse contrast or to flash during record. This is menu-selected.

Time Code

The 702T uses time code circuitry developed by Ambient Recording GmbH, a leading developer of stable, portable time code products (visit Ambient on the web at www.ambient.de). Clock stability and continuity are critical aspects of the 702T time code implementation. Its temperature-compensated crystal oscillator ensures rock solid TC stability and accuracy (< 0.2 ppm when tuned with an Ambient Master Controller).

Depending on the stability of other time code devices used with the 702T, time code can be accurate throughout an entire production day. Typically, a jam sync is performed after each time the camera is power cycled. In the absence of power, the 702T holds accurate time code for up 2 hours between battery changes using its internal, rechargeable AA NiMH time code cell. After two hours without power, the 702T reverts to a less precise time-of-day crystal to maintain the date/time of the unit. The time code/time-of-day battery is charged from internal or external power whenever the 702T is powered up.

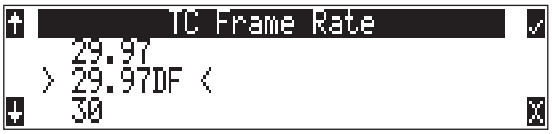
If the time-of-day clock is reset during the production day or if the time code mode is changed from 24 hour run to another mode and back, the time code value will change. You must re-jam all time code devices to ensure proper synchronization.

File-based recorders place a single time code stamp in the data header of an AES31 (Broadcast WAV) file. The 702T generates SMPTE time code from this number and extrapolates it based on the time code frame rate for playback.

All files generated by the 702T have time code numbers begin on the 0 frame (or 02 in DF modes). If necessary, pre-roll is dynamically applied to accomplish this. This simplifies synchronization in post-production. Furthermore, all files end on the 0 frame such that a file's duration is always an integer number of seconds long. If necessary, post-roll is applied to accomplish this.
Sound Devices Wave Agent Beta for Mac OS and Windows computers allows users to add or edit Beginning Time Code Stamps. *See Wave Agent Beta for more details.*

Frame Rate

A single time code frame rate is selected in the **TIMECODE:FRAMERATE** menu.



The 702T supports all of the common production time code rates, including:

- **23.976** – used with Sony high definition video cameras
- **24** – to sync audio to film where no transfer to NTSC video is expected
- **25** – to sync sound to PAL video
- **29.97** – to sync sound to NTSC SD video shot in non-drop frame mode and Panasonic high definition cameras
- **29.97DF** - to sync sound to NTSC video shot in drop frame mode
- **30** – to sync sound to film where transfer to NTSC SD downconvert is expected
- **30DF** – to sync sound to film for transfer to NTSC video in drop-frame mode 29.97 fps
- **30+** – Records at 48.048 sampling rate at 30 frames per second but stamps the file at 48kHz, 30 frames per second.

Sound Devices Wave Agent Beta for Mac OS and Windows computers allows users to change the Frame Per Second Stamp of any file. This is useful when the wrong Frame Rate was selected at the time of recording. See Wave Agent Beta for more details.

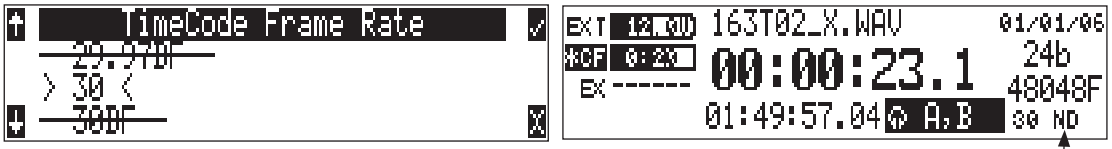
F Sampling Rate Modes

48.048k and 48.048kF

The 48.048kF mode (F stands for fake, faux, Fostex—take your pick) is a specific compatibility mode for use with the Fostex DV40 software (1.74 and previous), Avid, Final Cut Pro, and other post-production environments. The 48.048kF mode can aid in obtaining an NTSC 0.1% speed pulldown without sample rate conversion. In this mode files are recorded at a 48.048 kHz sampling rate but are stamped at 48 kHz. When played at 48 kHz, they will play back 0.1% slower than real time.

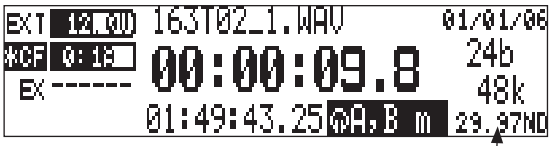
One use for the 48.048kF mode is to force a 0.1% speed reduction (pull down) of audio to match MOS-telecined film (24 fps-to-NTSC SD) in non-linear edit systems, such as Avid or Final Cut Pro. Since the file is stamped as a 48 kHz file, the edit system will play it back at 48 kHz and not at 48.048 kHz. This “audio pull down” will match the transferred picture without the need for an intermediate step through other software or though an analog conversion to create the pull down.

The time code frame rate (actual recording rate) is forced to 30 ND in 48.048kF mode. The front panel of the unit will show 30 ND during recording. No other frame rate is available in 48.048kF mode.



the file is recorded at 48.048 k, 30 ND

The sound file, however, is stamped with a 29.97 ND frame rate, along the 48 kHz sampling rate. It will appear as if the file was originally recorded at a 48 kHz sampling rate at a TC rate of 29.97 ND.



on playback, file appears at 48 k, 29.97 ND

Fostex DV40

When using files recorded in the 48.048kF mode with a Fostex DV40 with an older software version, set the DV40 time code frame rate to 29.97ND. Time code stamps will properly match the original time code start times.

47.952k and 47.952F

Both 47.952 and 47.952kF settings use a record sampling rate of 47.952 kHz, 0.1% lower than 48 kHz. The 47.952F mode, however, identifies the file as being recorded at 48 kHz. Additionally, in 47.952kF mode, the time code rate is restricted to 29.97ND, while the file is identified as 30ND.

47.952kF mode is useful in applications where the 702T is recording in high-def environments with cameras at 23.97 and post production is using a straight 24 frame session.

It is very important to know what file type is required and expected in telecine and transfer. Make certain to contact the person performing the transfer to make certain your files will be readable.

Time Code Modes

The 702T includes the following time code modes:

Off

The time code generator is disabled. The front panel time code display is blank.

Free Run:

The internal time code generator runs continuously without regard to the record mode. Any time code value can be used as the start value by "jamming value" in the jam menu.

Record Run

The time code generator runs only when the 702T is recording. Time code in this mode defaults to 00:00:00:00 at power-up. When switching to record run from another mode, the internal generator will stop at the last number generated. A user-defined value can be jammed into the internal generator from the jam menu.

Free Run Jam Once

The on-board time code generator will re-jam from external time code whenever a valid, running time code signal is connected to the TC input. Similar to free run mode, the generator runs continuously without regard to record mode. For a jam to occur, the time code signal must be disconnected and re-connected to the time code input. Free run Jam Once is useful when using the recorder as a slave, although one of the External TC modes may be more appropriate for slaved operation.

24 Hour Run

Identical to free run with the exception that the generator will automatically jam itself from the time-of-day clock on power-up. The generator will also re-jam if the time-of-day clock is reset. Once jammed, the generator will run continuously from the time code clock, not the time-of-day clock.

Ext TC

The internal time code generator follows an external time code signal appearing at the time code input.

Ext TC/cont

The internal time code generator follows an external time code signal appearing at the time code input. If the external time code is removed the internal generator continues to run to preserve continuous time code. Useful for time code transmission over RF where RF "hits" may interrupt time code.

Ext TC-Auto Record

The internal time code generator follows the external time code signal appearing at the time code input. When external code advances, the 702T enters record mode automatically. When the external code is stopped, the 702T generator pauses and recording is stopped. This is appropriate when dual-system sound is used with video cameras set for Rec Run time code. The video camera will function as master time code and the recorder "transport" will follow the video camera transport.

Ext TC/cont-Auto Record

The internal time code generator follows the external time code signal appearing at the time code input. When external code advances, the 702T enters record mode automatically. When the external code is stopped, the 702T generator pauses and recording is stopped. If the external time code is removed the internal generator continues to run to preserve continuous time code. Useful for time code transmission over RF where RF "hits" may interrupt time code. This is appropriate when dual-system sound is used with video cameras set for Rec Run time code. The video camera will function as master time code and the recorder will follow.

Time Code Hold Off

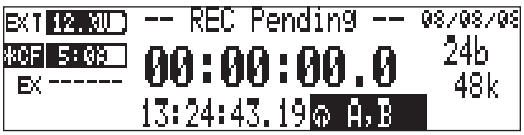
In the industry there are a wide variety of time code generators. Time code streams are standard from device to device; however, the start and stop sequence of the time code stream can differ. Because of this, the 702T recorders are susceptible to generating unintentional takes when in **EXT TC - AUTO RECORD** or **EXT TC/CONT - AUTO RECORD** modes.

Time Code Hold Off is designed to eliminate unintentional takes from occurring. The user can determine a duration in which a valid external time code signal has to be detected before the recorder generates a new take. The value of Time Code Hold Off needed is dependent on the start and stop sequence of the master time code source.

To use the Time Code Hold Off feature:

1. Access the Setup Menu option **TIMECODE: HOLD OFF.**
2. Set a value between 0 and 8 seconds in .1 second increments using the soft Up and Down Arrow (Menu and HDD) keys or the Multi Function Rotary Switch. 2.0 seconds is the factory default.

3. Save the selected value by pressing the soft Check Mark (Tone) key or by pressing in on the Multi Function Rotary Switch.
4. Exit the Setup Menu by pressing the soft X (Brightness) key or the Stop key.
5. Begin rolling time code from the master time code source.
6. The 702T will display the Record Pending message immediately after detecting a time code signal.



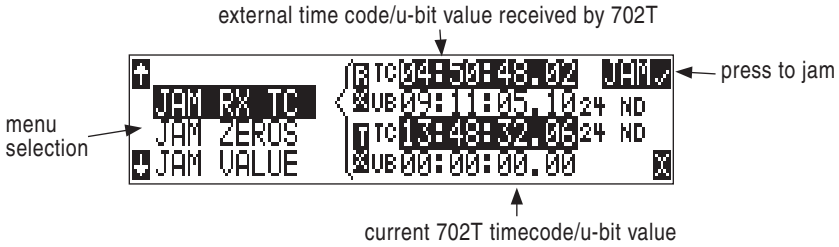
7. When the selected Hold Off value has elapsed, the 702T will begin recording.

Things to consider when using Time Code Hold Off:

- This feature only applies in **EXT TC - AUTO RECORD** and **EXT TC/ CONT - AUTO RECORD**.
- If Pre-Roll is set, it will be applied. Pre-Roll will only capture audio from the initial detection of a time code signal. If no Pre-Roll is selected, the file will begin after the Hold Off time expires. It is best practice to set Pre-Roll, in the Setup Menu option **REC: PRE-ROLL TIME**, to a value greater than the selected Hold Off value. This ensures that audio is captured from the moment a time code signal is detected and unintentional files triggered by short bursts of time code are not generated.

Jam Menu

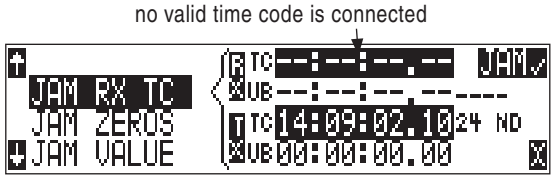
Time code setup is done from the jam menu selection, **TIMECODE JAM MENU**. Pressing and holding the HDD drive button then the MENU menu button enters the jam menu. In this menu, the top of the display shows the value of signal present on the time code input and the bottom of the display shows the currently set time code value. In addition, the 702T displays the frame rate of the incoming time code and the current frame rate setting of the 702T.



The 702T time code generator can be set in three ways.

Jam RX TC

When the JAM RX TC menu item is highlighted in the jam menu, the external time code, user bits, and frame rate are shown at the top of the LCD screen; the 702T internal generator, user bits, and frame rate are shown at the bottom of the screen. To jam the 702T from an external value, press soft button next to the jam button or the Rotary Switch button. The screen will display **JAMMING**. Once the 702T is jammed to the external time code, the external and internal numbers will match and run in sync.

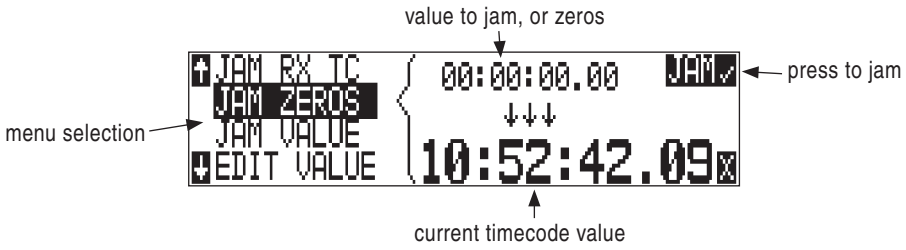


Make certain that the external time code source appears in the time code jam menu. If the 702T does not receive valid time code from the sending source the jam menu displays lines in place of numbers.

Identical to the Ambient Recording series of time code products, the 702T time code generator can "cross jam" select frame rates. The 702T will cross jam time code at the top of the second for phase-accurate (the 00 frames will match) time code at the set frame rate.

Jam Zeros

This menu selection resets the internal generator to zero.



Jam Value

Press the soft button **JAM** (tone button) or the Rotary Switch button to jam the user-entered time code start value into the internal generator.

Edit Value

This menu allows the user to set any valid time code value (**00:00:00:00–23:59:59:29**) for entry with the jam value selection above. The initial screen of this menu shows the currently set value as well as the current time code setting of the 702T. Press the soft button labeled **EDIT** or the Rotary Switch to select a specific time code value. Time code numbers are changed in pairs (hours, minutes, seconds and frames). Once **(DONE)** is selected the value can be "jammed" into the internal generator.

A value is not jammed into the 702T time code generator until **JAM VALUE** *is selected.*

User Bits

The 702T has seven user-selectable user bit modes. Time code user bits are a portion of the time code data which can be allocated several different ways. Commonly, user bits carry information such as the date, take, sound roll, or the camera roll number.

Highlight **EDIT U-BIT** in the jam menu and select the soft key **EDIT** to make change to user-adjustable user bits. Highlight Press the soft enter (tone button) or the Rotary Switch to enter user bit edit mode. The screen will show the format and setting of the user bits. Using the Rotary Switch or the soft-button up and down arrows, user bit digits can be edited (in pairs). Once **DONE** is selected, the user bits are set. If editing is not available in the selected user bit mode "**NO USER EDITS**" will appear in the screen.

NTSC Standard Definition (SD) Video Production

Audio Chasing Video

With many video productions, the video camera operates in a Rec Run time code mode. This eases logging of video information and helps eliminate duplicate time code numbers in editorial. One of the 702T's external time code modes can be used to write the picture's time code value to the audio file.

Drop Frame

NTSC video uses a frame rate of 29.97 frames per second. Unfortunately, that leaves 108 frames per hour unaccounted. To keep 29.97 time code in sync with "clock" time, the concept of "drop frame" was devised. Two frames are dropped at the top of each minute not divisible by 10. 54 drops per hour x 2 frames = 108 frames per hour.

To sync the 702T to a video camera, first determine if the camera is in drop frame or non-drop frame mode. If you, the DP or the producer are unsure about what setting to use, check with post-production, if possible.

As a rough guideline, video production for NTSC news segments is often drop-frame. Whether at drop or non-drop rates, make certain all time code devices are at the same rate.

1. Set the 702T to either 29.97DF or 29.97 respectively.
2. Jam the camera from the 702T using a LEMO-5 to BNC adapter cable connected to the time code input on the video camera.
3. Switch the camera to free run time code. The 702T time code should appear in the time code display on the camera.
4. Disconnect the time code cable.

The camera and recorder time code should now be running in sync. Check it after roughly 5 minutes to be certain synchronization is maintained.

Video cameras are notorious for time code instability when switched off. If the video camera must be shut down, re-jam it when it is powered back up.

Recording

The user interface of the 702T has been designed to be very similar to a "tape recorder". Recording and playback functions are quite similar to that of tape-based machines.

Recording

The largest, most easily accessed control on the 702T is its record key. Recording takes priority over all activity except for disk formatting, disk speed tests, and file transfers. The 702T immediately enters record mode when the REC key is pressed. When recording, the adjacent red LED will illuminate to indicate that the unit is in record mode.

In the event that the system is not ready to begin a new file, the recorder will enter standby mode. "REC Pending" will appear in the File Name field of the LCD display and the adjacent red LED will flash. The 702T will immediately begin recording as soon all selected media is ready.

If no inputs are routed to tracks, recording cannot take place. Make certain that at least one record track is assigned for recording.

Recording integrity is further enhanced through a process of periodic, automatic file directory and header updates written to disk during recording. This ensures file integrity in the unlikely event of a total loss of power.

The auto save feature does not apply to MP3 or FLAC recordings. If power is lost while recording to these formats the recordings maybe invalid.

While recording, the power, Fast Forward, Rewind, Input, Tone, and HDD File Viewer buttons are disabled. Stop recording by pressing and holding the STOP button. The STOP button must be held for 150 ms or greater to end recording. Although you can enter the Setup Menu during recording, menu items that affect recording are lined out in the menu list.

During recording, subsequent presses of the Record button can perform one of three setup-menu-selected actions:

- no action,
- new cue - cue markers are set within the file being written,
- new file - a new file is started with each press of the record button, the take counter is increased by one.

When removing the Compact Flash card after recording, always observe the amber CF activity LED. If it is lit, wait until it goes out before removing the card. If you remove the CF while the LED is lit, the file will be corrupted and there is a possibility of FAT corruption as well.

Pre-Record Buffer

To prevent missing record cues or up-cutting takes, the 702T has pre-record (or pre-roll) buffering available. When active, pre-record begins recording at a set number of seconds PRECEDING the record button being pressed. The amount of pre-record is sample-rate-dependent. At 48 kHz, ten seconds of buffered audio is available. At a 96 kHz sampling rate five seconds is available. At very high rates (192 kHz) two seconds of pre-record buffer is available.

Record buffering is disabled when the time code mode is set to Record Run, External Time Code Auto Record, and External Time Code Continuous Auto Record.. This prevents possible overlapping time code numbers between adjacent files.

Failure During Recording

In the event of a recording media failure the error will be indicated on the front panel and by a tone in headphones. Possible causes of media failure include a full CompactFlash card or a card not capable of keeping up with the record data.

Front Panel Lockout

See *Panel Lock* on page 8 to engage panel lock to prevent changes while recording.

Record Pause

This allows a recording to be stopped then continued without creating a new take or file. Record Pause is useful for live music recording, reporter interviews, or any other application that can benefit by stopping and starting recording without generating a new file. To use the Record Pause Feature:

1. Access the Setup Menu option REC: Record Pause and select Enabled.

The Record Pause feature does not support time code. If the Record Pause Enabled setting is crossed out, time code is active and must be turned off before Record Pause is available.

Navigate to the Setup Menu Option **TIMECODE: MODE** and set it to Off.

2. Press the REC key to begin recording.
3. Pause the recording at any time by pressing the STOP key once. When paused the absolute time and Record LED will flash.
4. Press the REC key again to continue recording.
5. Press the STOP key twice will finalize the recording. At this point, the file is available for Playback and the next press of the REC key will begin recording the next incremented take.

Things to consider when using Record Pause:

- Time code must be Off.
- Multi-unit linking using the C. Link connection is not supported.
- Pre-Roll is only added at the beginning of a file or take. Pre-Roll is not added when recording is resumed from the paused state.

Record Timer

The 702T is equipped with a record start and stop timer. This allows a user to record a take at a specific time from an unattended recorder. Set the start time in the Setup Menu option **REC: TIMER START** then set the record stop time in the Setup Menu option **REC: TIMER STOP**. The 702T will only start recording if the recorder is On when the timer start time elapses.

Playback

The 702T has high-resolution playback circuitry and is appropriate for any reference audio application. Any file recorded by the 702T can be played back, including MP2, MP3, FLAC, and WAV files. Whether files were recorded from the 702T or from copied to a CompactFlash card using a card reader, the 702T will recognize valid audio files. In addition, files copied to CF from a computer can be played back in the recorder. This is useful when using the 702T as a high-resolution playback device.

When play is pressed, the 702T defaults to playing the most recently recorded (or played) sound file, unless another sound file is selected. There are two ways to select sound files for playback.

- Press either the FastForward or Reverse button to put the 702T in to play-stop mode. The file name display will flash and the FastForward and Reverse buttons can be used to step through sound files in the currently selected file folder.
- To select files in other folders, press the HDD button to enter the File Viewer. Navigate to the appropriate file folder by scrolling up and down the file list. Highlight the sound file for playback and press play.

AutoPlay

The 702T can be set to play back all valid sound files in a folder. Files will play back in their order they were placed in the folder. Autoplay can be set with the following options:

- **Disabled** – auto playback is off
- **Play all** – all files in the folder will play, then stop when all files have been played
- **Repeat one** – the selected file will play back continuously until stopped by the user
- **Repeat all** – all files in the folder will play in succession, then repeat until stopped by the user

Audio File Formats

The 702T records audio to the industry-standard Broadcast Wave file format, either monophonic or polyphonic, MP2, MP3, or FLAC. Files created by the 702T receive the .WAV, .MP2, .MP3, .FLAC file extensions. The 702T will read files with the .BWF extension.

.WAV

The 702T has two file type options for recording WAV files, mono and poly. Select the file type in the Setup Menu option **REC: FILE TYPE**.

Monophonic

When WAV Mono is selected, the 702T will generate a separate audio file for each recorded track. The mono files generated by the 702T have file names similar to T01_1.WAV and T01_2.WAV. The file name suffixes, _1 and _2, identify the track number of the file.

Polyphonic

When WAV Poly is selected, the 702T will generate one audio file for each take. All recorded tracks are interleaved into this single file.

Wave Agent Beta allows for the splitting (de-interleaving) of polyphonic files and combining (merging or interleaving) of monophonic sibling files into a single polyphonic file. *See Wave Agent Beta.*

The 702T writes AES-31 Broadcast Wave formatted files. The audio files created by the 702T place additional information in the file header, called the Broadcast Audio Extension data chunk. Software that does not recognize this additional broadcast wave data chunk will simply ignore this added information. Among the values recorded are:

- time code stamp
- time code frame rate
- date and time of the original recording
- bit depth
- sampling rate
- originating machine serial number

.FLAC

Free Lossless Audio Codec is a lossless data compression algorithm specifically designed for audio. It is a convenient way to extend recording time with no effect on audio quality. It is suitable for recording and archiving. FLAC, in particular, offers data compression rates that range anywhere between 30% and 60%, depending on the audio program. Sound Devices Wave Agent Classic (**www.waveagent.com**) is a free Windows based software used to extract FLAC to WAV as well as combining monophonic files and splitting polyphonic files.

What to consider when recording FLAC:

- notes are currently disabled, all other metadata is stored
- limits your sampling rate to 96 kHz
- limits recording to only one storage medium at a time
- The 7-Series can play back the recorded FLAC files.
- Use Sound Devices Wave Agent Classic software (www.waveagent.com) to extract Broadcast Wave files from 7-Series recorded FLAC files.
- Auto save feature does not apply to FLAC files, if power is lost while recording the file maybe invalid.

.MP2

MPEG-1 Layer II is a lossy compression algorithm often used for speech recording.

What to consider when recording to MP2:

- time code is enabled (with BEXT or iXML data)
- mono recordings are not allowed with bit rates above 192k
- limits your sampling rate to 48 kHz
- limits your bit depth to 16 bit
- limits recording to only one storage medium at a time

.MP3

MPEG-1 Layer III is a lossy compression algorithm often used for music.

What to consider when recording to MP3:

- time code is enabled (no BEXT or iXML data)
- limits your sampling rate to 48 kHz
- limits your bit depth to 16 bit
- limits recording to only one storage medium at a time
- Auto save feature does not apply to MP3 files, if power is lost during recording the file maybe invalid.

The chart below indicates the limitations of all file types available on the 702T.

File Format	Bit Depth (bits)	Sampling Rate - kHz (Bit Rate – kbps)	Maximum Number of Tracks	File Extension	Multi-Medium Recording
PCM	16 or 24	32 to 192	2	.WAV	yes
FLAC	16 or 24	32 – 96	2	.FLAC	no
MP2 (mono)	16	32, 44.1, 48 (64, 96, 128, 160, 192)	1	.MP2	no
MP2 (stereo)	16	32, 44.1, 48 (64, 96, 128, 160, 192, 256, 320, 384) *	2	.MP2	no
MP3 (mono)	16	32, 44.1, 48 (32, 64, 96, 128, 160, 192, 256, 320)	1	.MP3	no
MP3 (stereo)	16	32, 44.1, 48 (32, 64, 96, 128, 160, 192, 256, 320) **	2	.MP3	no

* *For MP2-Stereo, the per-channel bit rate is half of the selected bit rate.*
** *MP3-Stereo uses Joint Stereo Coding, which improves per-channel resolution over MP2-Stereo but can not be quantified into a specific per-channel bit rate.*

iXML

The 702T includes iXML (revision 1.5) data in addition to the broadcast wave extension data. For iXML-aware software applications this data is available. For applications that don't recognize iXML, this information is ignored.

Notes

iXML supports notes fields. From the File Viewer select OPTIONS, then Notes.

Using an external keyboard via the CL-1 Remote Control and Keyboard Interface the entry of notes is much quicker than using the Rotary Switch.

If time code is turned off, metadata will still be written. Post-record metadata editing can also be performed using a Mac OS or Windows based computer with Sound Devices Wave Agent Beta. See Wave Agent Beta for more details.

Recording Time Calculation

The calculation of available 702T recording time involves three factors:

- **track count** - how many concurrent audio tracks are selected for recording.
- **data rate** - calculated from the sampling rate and bit depth for non-compressed audio and by bit rate for data compressed audio. Data rate determines how big the data "container" is for the audio signal (see the calculation below for determining PCM audio).
- **storage capacity** - typically expressed in GB

Uncompressed Recording Time in Track-Hours

Data Rate (bit depth/sampling rate), one track

Storage in GB (1000 MB = 1 GB)	16/44.1 (5.05 MB/min)	16/48 (5.49 MB/min)	24/48 (8.24 MB/min)	24/96 (16.5 MB/min)	24/192 (33.0 MB/min)
1	3.30	3.03	2.02	1.01	0.51
2	6.60	6.07	4.05	2.02	1.01
4	13.2	12.1	8.09	4.05	2.02
8	26.4	24.3	16.2	8.09	4.05
15	49.5	45.5	30.3	15.2	7.59
40	132	121	80.9	40.5	20.2
60	198	182	121	60.7	30.3
100	330	303	202	101	50.6

The chart above shows recording time available with the 702T. Time is expressed in hours per track (track-hours) at the specified data rate supported by the 702T. If recording two tracks, divide the track hours figure by two. Similarly for four-track recording, divide track-hours by four. Note that the 702T supports additional sampling rate / bit depth combinations, however, only the most common are included below.

Record Time

The chart shows that when recording 24-bit/48 kHz audio to a 40 GB hard drive the maximum amount of recording time available roughly 80 track-hours. If recording a stereo two-track file, this yields 40 stereo hours of record time.

Note that most storage media now quote capacity in GB using SI units, where 1000 megabytes equals one gigabyte.

PCM Audio

Uncompressed digital audio is expressed numerically by two measurements, bit depth and sampling frequency, such as 16-bit/48 kHz. These two numbers are used to compute the data rate of uncompressed audio.

Audio Data Rate = Bit Depth x Sampling Frequency

In the example below the data rate of a single 16-bit/48 kHz audio stream is computed in megabytes per minute. Division by 1,048,576 converts from bits to megabits. Division by 8 converts from megabits to megabytes; multiply by 60 converts seconds to minutes.

(((16 x 48000) / 1,048,576) / 8) x 60 = 5.49 MB/min

MP3 Compressed Record Time in Hours

MP3 Data Rate (bit depth/sampling rate), stereo track

Storage in GB (1000 MB = 1 GB)	64 kb/s (0.47 MB/min)	96 kb/s (0.70 MB/min)	128 kb/s (0.94 MB/min)	160 kb/s (1.17 MB/min)	192 kb/s (1.40 MB/min)	256 kb/s (1.86 MB/min)	320 kb/s (2.34 MB/min)
1	35	23	17	14	11	8	7
2	71	47	35	28	23	17	14
4	142	94	71	56	47	35	28
8	284	189	142	113	94	71	56
15	533	355	266	213	177	133	106
40	1422	948	711	568	474	355	284
60	2133	1422	1066	853	711	533	426
100	3555	2370	1777	1422	1185	888	711

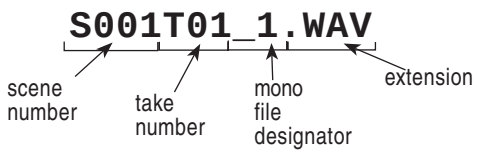
The chart above shows file time available with the 702T with MP3 files. Time is expressed in hours at the specified MP3 supported by the 702T. Note that all recordings are two-channel recordings.

Compressed Audio

When digital audio is compressed using some form of lossy, perceptual process such as MPEG2-Layer3 (MP3 audio), Windows Media encoding (WMA), ATRAC encoding (used in MiniDisc), AAC (MPEG-4 audio), or others - it can have a significant reduction in its data rate. Compressed audio has enabled the practical distribution of audio over low speed data networks.

File Naming / Numbering

Files generated by the 702T are named using a syntax made up of four parts: scene number, take number, mono track designator (if mono file is selected), and extension.



Post-record metadata editing can be performed using a Mac OS or Windows based computer with Sound Devices Wave Agent Beta. *See Wave Agent Beta for more details.*

Scene Name/Numbering

Scene names are selected for use from a scene name list. This list is accessed from the setup menu. Any number of scene name lists can be generated and these can be made up of any number of scene names. The advantage of scene name lists is that scene names can be built before production so that

Scene names are made with alphanumeric characters, including "_ " and "-" and can be any length between zero (0) and nine (9) characters in length. Scene numbers are helpful to match audio with the corresponding scene in a production. Scene names can also be used to identify other items, including recording date, artist name, or any other descriptor as required.

Scene names are user-selected in the Setup Menu and do not change until changed by the user.

To change scene numbers:

1. Enter the user menu and navigate to the Scene Name/Number option.
2. Use the REW (<<) and FF (>>) soft buttons to move among characters. Use the PLAY button to delete characters. Characters are entered from left to right and deleted from right to left.
3. Use the Rotary Switch or the soft button arrows on the left to choose characters. Press the Rotary Switch or press the fast-forward button to save the character and move to the next position.
4. To save the scene name, press the soft button labeled check or the Rotary Switch without selecting a character. After the ninth character is entered, the scene name is automatically saved.

If all characters are removed, no scene name will be written to files, only a take number. If Scene Folder is selected for file management, all takes will be placed in the root of the drive.

Take Numbers

Take numbers are integers between **01** and **32000**, with or without preceding zeros, which increase by one each time a new file is recorded. Take numbers can be set with or without a take separator, such as the character "**-**" or "**T**". Take numbers can be overridden and a new take number can be set in the Setup Menu. If the 702T detects a file with a duplicate name in the destination folder, a letter suffix, starting with "**A**" is added to the file name, before the extension. Note that take number handling can be selected to reset if set in the Setup Menu (see *File Management and Copying*).

To change take numbers:

1. Enter the user menu and navigate to the Take Name/Number option.
2. Use the REW (**<**) and FF (**>**) soft buttons to move among decimal places and to jump to the single alphanumeric take spacer character. Use the PLAY button to reset the take number to 1. Characters are entered from left to right and deleted from right to left.
3. Turning the Rotary Switch or pressing the soft buttons for up and down choose characters/numbers. Push in the Rotary Switch or hit the soft button labeled check to save the character and move to the next position.

From the user menu the action for take resetting is controlled from the following options:

- **Never** – take numbers do not reset
- **When scene is changed** – take resets when scene name is changed
- **When daily folder is changed** – takes reset on new day
- **Either scene or daily**– takes reset on either change

Mono Track Name Designators

When recording monophonic Broadcast WAV files each track is recorded in a separate data file. To identify each track, each file is identified by an underscore and track number suffix. The file of the first track recorded has "_1" appended to it. The file name suffix, _1 and _2 always correspond to tracks A and B, respectively. For instance, if track B is the only track recorded, it's file name suffix will be _2.

Duplicate File Names

When the 702T detects that a duplicate file name is going to be generated in a specific folder, the 702T changes the file name by adding of a letter suffix before the extension. For instance, if take numbers are reset but files are recorded to the same folder as previous files, a suffix "A" is added to the file. If additional duplicate files are generated the letter suffix increments, to B, C, etc.

Wave Agent Beta

Wave Agent Beta is a WAV file librarian for Mac OS and Windows computers. Designed for Production Sound Mixers and Post Production Editors, Wave Agent provides a comprehensive and indispensable range of tools for preparing audio files for problem-free passage through complex production workflows.

Wave Agent is an essential, time-saving tool for anyone working in Production Sound. It allows for the following;

- Playback of polyphonic and monophonic WAV and Broadcast Wave files from any source
- Viewing and editing file metadata
- Changing of sampling rate, frame rate, and start time code metadata stamps

- Splitting and combining polyphonic and monophonic files with selectable track assignments
- Batch editing
- Generating customized PDF and CSV Sound Reports
- Large time code display
- Monitor mixer with faders, pans, solos, mutes, and meters
- Drag-and-drop operation
- Comprehensive keyboard shortcuts for accelerated operation
- Mac OS and Windows compatible

Wave Agent is available as a no-charge software download for either Mac OS or Windows.

http://www.sounddevices.com/download/waveagent.html

File Management

The 702T, like a computer, saves audio recordings to a file system containing files and folders. The 702T formats its CompactFlash medium, and attached external drives as single drives named "**702T CF**"and "**702T EXTHDD,**" respectively. All files generated by the 702T can be saved to the Root Folder, a Daily Folder, or a Scene Folder.

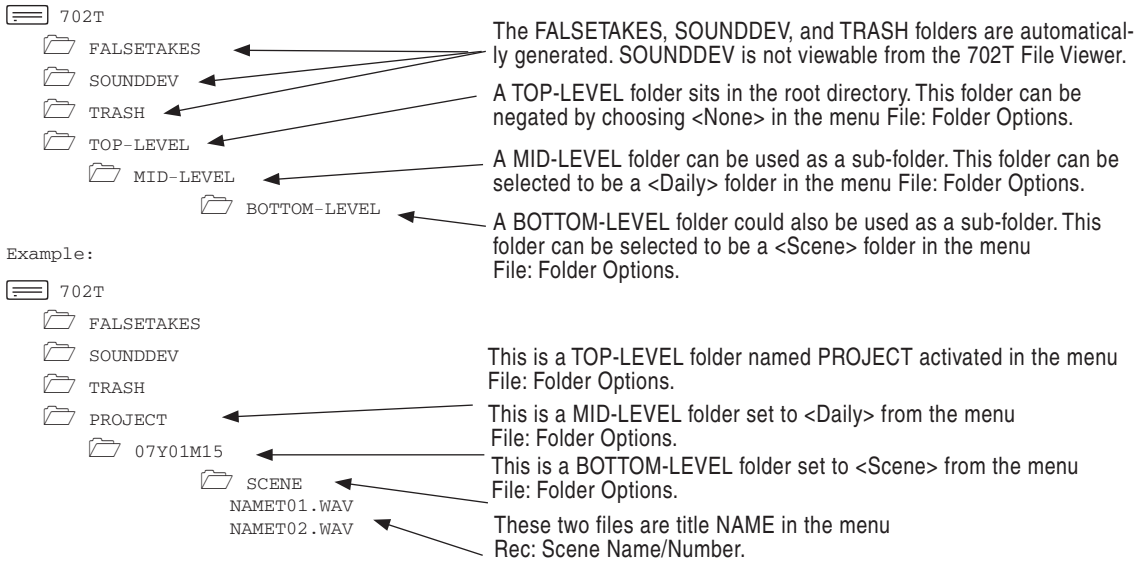
Folder Actions

All files generated by the 702T can be saved to the Root directory, a Project Folder, a Daily (Roll) Folder, or a Scene Folder (Files are saved to the Root directory by default). File organization is managed in the Setup Menu option **FILE: FOLDER OPTIONS**. Folder choices include **TOP-LEVEL, MID-LEVEL, AND BOTTOM LEVEL FOLDERS**. Folders are created when the record key is pressed. This reduces the likelihood of empty folders.

- **Top-Level folder** - is a root-level folder and can be set with a user-selected name. The Top-Level folder can also be de-activated by selecting <**NONE**> from the Setup Menu. If the Top-Level folder is not used then the next lower-level folder will reside at the drive's root. If the **TOP-LEVEL** folder is active then the **MID-LEVEL** and **BOTTOM-LEVEL** folders will be its sub-folders.
- **Mid-Level /Daily folder** - can be selected as a <**DAILY**> folder, a folder with a user-selected name, or not used. If a **TOP-LEVEL** folder is in use, the **MID-LEVEL** folder will be a sub-folder of the **TOP-LEVEL** folder. If no **TOP-LEVEL** folder is used the **MID-LEVEL** folder will reside at the drive's root. If set to <**DAILY**> a new folder will be created daily. When recording past midnight the 702T will prompt to make to a new daily folder.
- **Bottom-Level /Scene Folders** - can be selected as a <**SCENE**> folder which will use the name generated from **REC: SCENE NAME/NUMBER** Setup Menu, as a user-selected name, or not used at all. If no upper-level folder is in use, the **BOTTOM-LEVEL** folder will reside at drive's root. If the **MID-LEVEL** and/or **TOP-LEVEL** are in use the **BOTTOM-LEVEL** folder will be a sub-folder.

Example: If a daily Folder is desired, set the **TOP-LEVEL** to **<NONE>**, the **MID-LEVEL** folder to **<DAILY>**, and the **BOTTOM-LEVEL** to **<NONE>**. This will generate a Daily Folder in the root directory with it's files directly inside the folder.

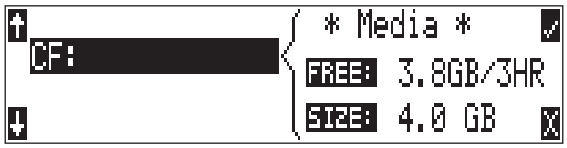
A hierarchical view of files generated by the 702T is below.


702T
FALSETAKES
SOUNDDEV
TRASH
TOP-LEVEL
MID-LEVEL
BOTTOM-LEVEL
The FALSETAKES, SOUNDDEV, and TRASH folders are automatically generated. SOUNDDEV is not viewable from the 702T File Viewer.
A TOP-LEVEL folder sits in the root directory. This folder can be negated by choosing <None> in the menu File: Folder Options.
A MID-LEVEL folder can be used as a sub-folder. This folder can be selected to be a <Daily> folder in the menu File: Folder Options.
A BOTTOM-LEVEL folder could also be used as a sub-folder. This folder can be selected to be a <Scene> folder in the menu File: Folder Options.
Example:
702T
FALSETAKES
SOUNDDEV
TRASH
PROJECT
07Y01M15
SCENE
NAMET01.WAV
NAMET02.WAV
This is a TOP-LEVEL folder named PROJECT activated in the menu File: Folder Options.
This is a MID-LEVEL folder set to <Daily> from the menu File: Folder Options.
This is a BOTTOM-LEVEL folder set to <Scene> from the menu File: Folder Options.
These two files are title NAME in the menu Rec: Scene Name/Number.

File Finder Navigation

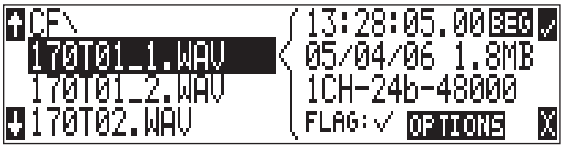
Moving from file to file on the recorder is similar to navigating among files on a computer.

1. Enter the File Viewer by either selecting **FILE:VIEW FILES** file in the Setup Menu or by pressing the front panel HDD button. By default the folder with the last recorded or played audio file will be opened. The 702T knows this file name by reading a text file, named SDINFO.TXT, which is written to each time the unit records or plays.
2. To move up the hierarchy scroll up to the top of the menu to "**\..**".
3. Press enter or push the Rotary Switch to go up one menu level.
4. From the root menu, selecting **\..** opens the media select screen.
5. Continuing up the file hierarchy the media menu is viewable. The top-most view in the heirarchy shows the inserted card's size and available free space.



Large audio files take longer to show details than smaller files; this is normal.

File Viewer Screen



The File Viewer screen contains information about each individual audio file. The left side of the display shows files and folders. The top line displays the path in the form of **MEDIA\FOLDER NAME**. File names are listed in the order they were recorded.

File types not recognized do not show up in the File Viewer, although all folders are viewable.

File details are shown on the right side of the display. The center divider points to the file selected for information viewing. Information shown includes:

- file creation date, file flag (archive) bit status, checked means the file archive bit is set, clear means the file archive bit is cleared
- file creation time, file size
- number of tracks, bit depth, sampling rate
- beginning (**BEG**) time code stamp of the file
- There is additional information available. Pushing the Rotary Switch will cycle through the beginning time code stamp (BEG), file length (LEN) user bits (USR), and frames per second (FPS).

The File Viewer always exits to the main screen whether entered from the Setup Menu or from the HDD button.

File Time and Date

Similar to a computer file system, all files recorded by the 702T are stamped with the time and date of file generation. To ensure that accurate time-of-day and file generation dates are written for each file, make certain that the time-of-day clock and calendar are accurately set.

File time and date and time code are unrelated.

1. Enter the **TIME/DATE: SET** menu.
2. Set the present time and date using the navigation tools below.

soft keys increment and decrement time and date, Rotary Switch can be turned, as well
Time & Date Set
01:59:20 PM
06/15/04 (done)
advances to the next selection
returns to the previous setting

Once set, the time and date clock will be kept while the removable rechargeable battery is attached. If it is removed the internal AA NiMH time code battery maintains the time-of-day and date for 20 days, or more.

File Size Maximum

The CompactFlash card is formatted as a FAT32 volume. This structure allows for the CF cards to directly mount on common computer platforms, either using the units FireWire or from a card reader. Using the FireWire connection the CompactFlash card in the 702T appears as an external FAT32 removable storage volume.

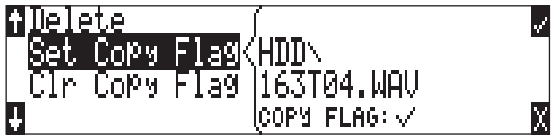
Windows XP has a limitation on FAT32 drive formatting; XP can format a FAT32 volume to a maximum of 32 GB, however it can read FAT32 volumes as large as 2 TB.

FAT32 has a maximum individual file size limitation of 4 GB. While it is possible to have thousands of files on the 702T CF card, the largest any single file may be is 4 GB. The 702T automatically splits audio files before the 4 GB size is reached and begins recording to a new file. When joined in an editing program, these files match seamlessly with no samples lost. The 702T has a menu-selectable file size maximums of 512 MB, 1 GB, 2 GB, and 4 GB. The factory default setting for maximum file size is 2 GB. Some applications will not properly import audio files above 2 GB. The 512 MB size makes

long form recordings easy to split up into CD-R sized files for backup to inexpensive CD-R medium. There are numerous file size breaking points sizes to ensure that files recorded will fit onto specific media.

Setting/Clearing Flag Bits

Pressing the tone key in the File Viewer display opens the "**SET OR CLEAR FLAG BIT**" screen. The options for setting or clearing flag bits include: set or clear the selected file, set or clear all the files in the current folder, or set or clear all files on the volume.



All files created by the 702T have their archive bit set to on.

Automatic Flag Clearing

The recorder can be set to clear the flag bit of copied files automatically. When enabled in the Setup Menu option **FILE: COPY FLAG RESET**, all files copied internally by the recorder will have their flag bits cleared on the original file. Flags are not cleared when copying to a computer over FireWire.

File Copying Among Available Drives

Audio files are easily transferred between CF and the external drive. File transfer is initiated with the setup menu option **FILE:COPY FILE**.

The Copy File menu has four options for each media type:

Copy All [Media] > [Media]:
Copies all files from one media to the other.
Last 24Hr [Media] > [Media]:
Copies files created in the last 24 hours between media.
Last 48Hr [Media] > [Media]:
Copies files created in the last 48 hours between media.
Flagged [Media] > [Media]:
Copies all files with their archive bit set between.

Once file copying has begun, the 702T searches the source media for the selected files. The 702T will then search the destination drive looking for duplicate file names. The LCD will report the number of files found, the number of duplicates found and the net number of files to be copied and prompt to continue.

Pressing the enter key or controller button begins copying. The LCD will report progress of the file being copied and the number of files remaining to be copied. When file copy is complete, the 702T will report the number of files successfully copies and show a progress bar showing the percentage of files successfully copied.

Error Conditions:
If a file is to large for the destination medium, the 702T will give you the option to skip the it or cancel copying. If an error occurs during file copying, the 702T will prompt to cancel the transfer. When the destination medium is full, the 702T will report the error and end the transfer.

File Deletion

Any file or folder on either CompactFlash or external FireWire drive can be deleted. Permanently deleting files is a two-step process. Similar to Mac OS and Windows operating systems, the 7-Series uses a "trash" folder to temporarily hold files which have been deleted. To send a file to the trash, perform the following:

1. Press the HDD button to enter the File Viewer.
2. Navigate to the file to be deleted.
3. Press the soft key marked **OPTIONS**.
4. Select **DELETE**.
5. You will be prompted to verify file deletion.

The file has now been moved to the trash folder and will no longer appear in the file listing. It will, however, appear in the trash folder. Files sent the trash folder can be viewed and played.

If a file or folder has accidentally been sent to the trash the drive can be mounted to a computer via FireWire and moved back to its original folder. Files and folders moved to the trash cannot be removed from the trash from the 7-Series recorder.

False Take Control

To identify a take as a false take, perform the following:

1. Press stop to end recording.
2. Wait for the file to finish writing, the activity LED will turn off
3. Hold down the stop key and press rewind to be prompted to delete the most recent take.
4. Press the soft check box to delete the take.

Files that have been deleted as false takes are moved to the **FALSETAKES** folder and the file's metadata False Takes flag is set to true. The False Takes folder sits in the drive root. When recording to CompactFlash and external FireWire storage devices files from each media will be moved to each media's **FALSETAKES** folder. False takes will remain on the drive until the **FALSETAKES** folder is deleted. *See Emptying the Trash and False Take Folders.*

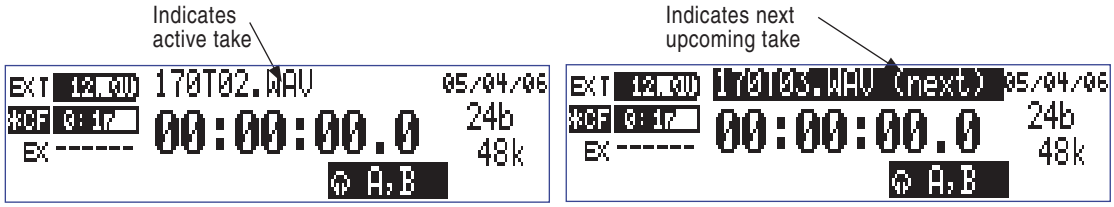
Emptying the Trash and False Take Folders

Files that have been moved to the trash and false take folders (see below) can be permanently deleted from the recorder. Each drive has its own Trash and False Take folders and they are permanently deleted independently.

Once the trash and False Take folders have been emptied, any files or folders they contain are permanently deleted and cannot be recovered.

Take Number Increments

To advance to a higher take number hold the STOP button and press FastForward. The file name to be recorded is indicated above the file time.



Take List

The take list shows a sequential listing of the last 200 recorded files, without regard to what folder they have been recorded in. The first file in the list, marked with an * indicates the file name of the next recorded take. Subsequent takes are listed in the order of recording from the 7-Series. Only files recorded on the unit will appear in the take list, unlike in the File Viewer, where all valid sound files are shown.

From the take list several controls are available. Take Number Incrementing is available, as well as False Take deletion. Soft keys move among take numbers. Takes can also be marked as No Good or Circled. *See Take Status for details.*

Take Status

Takes recorded by the 702T can be marked as Circled or as No Good. Take Status is used to mark the quality of the take so that post can quickly identify which takes to use. The Take Status of the last take recorded can be quickly changed in the Take Status Menu. Any take recorded prior to that must be changed in the Take List. Take Status changes are applied to all available media that recorded the selected take. If one of the media has been removed and a Take Status change is performed, the 702T reports "Warning: Media Not Open".

Circle Take

Circled Takes are generally the best quality or "print" take. Takes are marked as circled so that post is quickly able to identify which take to use.

Takes that are circled are renamed to include the "@" symbol preceding the file name. Additionally, Circled Takes are tagged <CIRCLE>= TRUE in the iXML chunk.

No Good

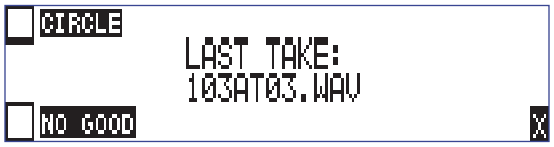
No Good or NG takes are generally takes that have useful material but are not the best take recorded. Takes are marked as No Good so that the Dialog Editor is able to quickly find alternate takes that may have useful material.

Takes that are marked as No Good are renamed to include the "$" symbol preceding the file name. Additionally, No Good Takes are tagged <NO_GOOD>= TRUE in the iXML chunk.

Takes are either No Good or Circled, they cannot be marked as both.

To quickly identify the last recorded take as Circled or as No Good, perform the following steps:

1. Press the STOP key to end recording.
2. Press and hold the STOP key down, then press the LCD Backlight key to enter the Take Status Menu.

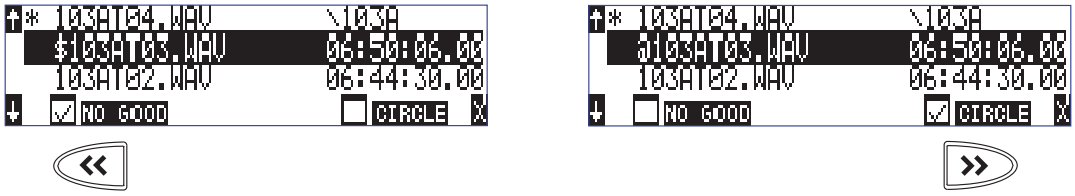


3. Press the soft Circle (Menu) key to mark the take as Circled or press the soft No Good (HDD) key to mark the take as No Good. The check mark appears in the selected box and the 702T automatically returns to the Main Display.

To identify any take in the Take List as Circled or No Good, perform the following steps:

1. Press the STOP key to end recording.
2. Press and hold the STOP key down, then press PLAY to enter the Take List. The Take List can also be accessed via the Setup Menu option **`FILE: VIEW TAKE LIST`**.
3. Scroll among files to find the take that is to have its status changed.

4. Press the soft No Good (Rewind) key or the soft Circle (Fast Forward) key. To remove the take status indication, highlight the No Good or Circled file and select “No Good” or “Circle” again.



5. Press the soft X (LCD Backlight) key or Stop key to exit the Take List.

CompactFlash Recording Media

CompactFlash (CF) is an excellent portable storage medium for audio recording. Its speed and capacity continue to increase as its price continues to come down. The 702T records to and plays from CF cards as its primary storage medium.

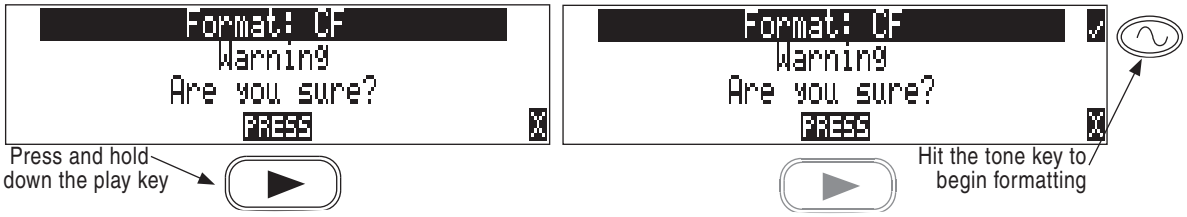
The key benefits of CompactFlash include:

- wider temperature range capability than hard disk drives
- greatly increased shock immunity versus hard disk drives
- convenient, portable, removable media
- ubiquitous card readers and transfer tools

Formatting

Upon insertion of an unformatted (or non-FAT32 formatted) CF card, the 702T will indicate that the card is not formatted and request the user to format the card. If the card was previously formatted as a FAT32 volume, either from the 702T, a computer, or another audio recorder, the card will be ready for recording. To format the CF card, perform the following:

1. Ensure that all files on the card have been copied or are no longer needed.
2. Enter the Setup Menu and use the Rotary Switch to scroll to **CF: ERASE / FORMAT**.
3. Press the Rotary Switch button to begin formatting.
4. To verify that a non-recoverable format of the storage device is desired two keys must be pressed to begin formatting. Press and hold down the play key to enable the check mark. Hit the tone key (check mark) to begin formatting.



Formatting the 702T CompactFlash card can take up to 20 seconds. When formatting is complete, the 702T will generate a fresh menu hierarchy, including the daily folder, if selected. Dynamic lists such as track names, scene names, folder options, etc... will be saved.

The 702T can format and use Compact Flash cards with a minimum capacity of 64 MB. There is no practical limit to the maximum Compact Flash card capacity (2 TB).

Formatting the CF rebuilds the FAT (file allocation table) and erases all audio and data files present on the card. While some PC and Mac utilities can recover files immediately after formatting a CF card, consider that the files have been permanently erased. FAT32 volumes may not be compatible with some consumer electronic devices, including entry-level digital cameras (these may only support FAT/FAT16 volumes).

After recording to CF has stopped, it may take several seconds for the 702T to finish "housekeeping" on the card. Before removing the card, always observe the amber CF activity LED. If it is lit, wait until it is off before removing the card. If the CF is removed while the LED is lit, at the very least the file will be corrupted and there is a possibility of FAT corruption as well.

Speed Testing

CF cards vary widely in their read and write throughput. Later generation "24x" and greater CF cards can reliably read and write multi-track, high sample rate audio. The 702T includes a drive speed test to measure the throughput speed of CF medium.

The speed test reports the throughput of the card by generating a test file, then reading it. The speed test can vary from test to test depending on the amount of free space on the drive, the amount of

fragmentation, and other factors. Use the speed test as a general, relative measurement from one card type to another.

Few CF cards can sustain write speeds for reliable 192 kHz recording. Sound Devices strongly recommends using only the fastest cards to record at sampling rates above 96 kHz.

Qualified CF Cards

Sound Devices does not specifically "qualify" CompactFlash cards for use in the recorder. From our tests of numerous cards—including medium from Lexar Media, SanDisk, and Kingston Technology—cards in capacities from 128 MB and above will successfully operate in the 702T. The unit will support up to 2 TB of data. Small capacity cards may not format as FAT32 and may not be usable. Use the CF transfer speed test to verify that an installed card can support the needed read/write speed.

Storage Medium – External FireWire Drives

The FireWire port on the 702T can function in either "host" mode or "drive" mode (see *File Transfer Using FireWire* for additional information on drive mode). In host mode an attached FireWire storage volume such as a hard drive or DVD-RAM can be used to record and play back audio files. To activate host mode select **EXTERNAL DRIVE** via the Setup Menu item **FIREWIRE: CONNECTION**. Because the 7-Series can write to all available mediums simultaneously the ability to write to an external drive reduces the need for post-record copying of sound files.

External FireWire drives require 2.0-ready 702T hardware. Only recorders specifically labeled 2.0 ready are able to connect to external FireWire drives as an available storage medium.

When to Use External FireWire Drives

The key benefits of recording to external drives include:

- the choice of drive types include DVD-RAM optical drive or hard drive
- near limitless recording capacity when a large volume external hard drive is attached (up to 2 TB)
- fast, no-waiting simultaneous record option
- post-record copying to quickly back up CompactFlash medium

Formatting

Identical to the CompactFlash card, attached FireWire drives are formatted as FAT32 volumes. Upon connection to an unformatted (or non-FAT32 formatted) external drive, the 702T will prompt the user to format the drive. If the drive is already formatted as a FAT32 volume the drive will be ready to be selected as a storage medium. The front panel drive LED will illuminate to show which drives are available for recording. To reformat an attached drive, follow the same procedure as formatting the CompactFlash, substituting the external drive menu selection for the CF.

After recording to an external drive has stopped, it may take several seconds for the 702T to finish "housekeeping" on drive. This is especially true when recording to DVD-RAM disks, which generally have slower throughput than hard drives. When preparing to disconnect a FireWire drive, always observe the amber activity LED labeled EXT. If it is lit, wait until it is off before disconnecting the drive. If the drive is disconnected while the LED is on, there is a high likelihood that the file being written will be unusable and there is a possibility of FAT corruption on the drive.

FireWire Bus Powering

The six-pin FireWire port on the 702T provides power for bus-powered FireWire drives. The following conditions should be observed when connecting to bus-powered drives.

- Bus powering a drive requires external DC powering of the 702T. The 702T cannot operate bus-powered drives from an attached Li-ion battery.
- When recording in realtime to bus-powered FireWire drives the XL-1394 FireWire Power Filter is recommended. This filter network isolates the electrical noise in bus-powered drives from the 702T.
- While hot-swapping FireWire cables is possible it is recommended to attach bus-powered drives with the recorder turned off.

Qualified Drives

External FireWire storage volumes that can be formatted and addressed as FAT32 can be used with the 702T. These include:

- external hard drives, bus-powered or mains powered. Drives as large as 2 TB can be addressed,
- FireWire CompactFlash card readers,
- DVD-RAM drives.

FireWire drives use a variety of chipsets to perform conversion from the drive's native format (i.e. IDE) to FireWire. Sound Devices has tested and qualified enclosures and card readers which use the Oxford 911, Oxford 922, PL3507, GL711, and FW912 chipsets. Other chipsets may operate, but Sound Devices does not officially support them. To check for compatibility with the 702T attach a FireWire drive and run the media speed test selected from the User Menu. This will write, then read a file to the drive. If the drive can perform this test then it can be used to record audio.

DVD-RAM Drives

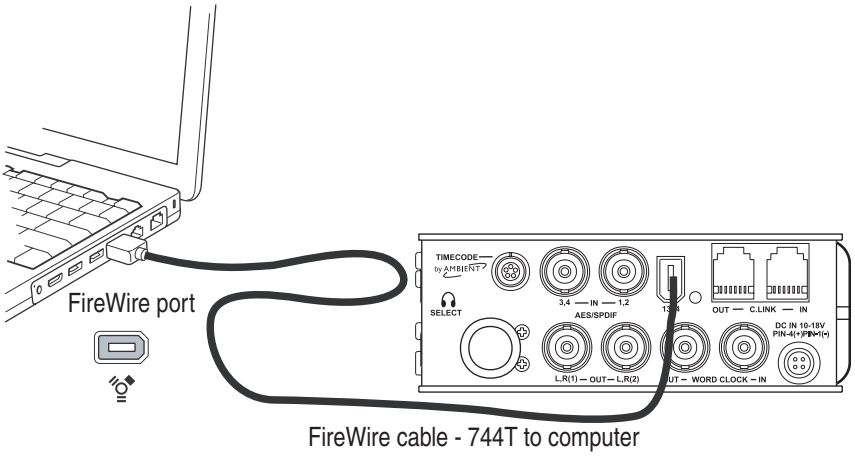
DVD-RAM drives are essentially optical hard drives. Revision 2.00 firmware supports recording to and playing back from DVD-RAM drives when formatted as FAT32 volumes.

When recording to DVD-RAM drives in realtime it is important to note the following:

1. Keep sampling rates below 48048.
2. Record to polyphonic file formats.
3. Use DVD-RAM drive mechanisms and media that support 3X recording speeds.

Post-record copying from CF to external drives is recommended for material recorded at high sampling rates.

File Transfer – FireWire



The 702T's FireWire (IEEE-1394) port makes transfer of recorded files to a computer quick and easy. When connected, the CompactFlash card of the 702T will mount to a Mac OS X or Windows computer as a local, removable mass storage devices. Using Mac Finder, Windows Explorer, or any other file utility, files can be copied, read, and deleted directly to and from the 702T Compact Flash card.

It is best practice to copy original sound files to the computer before editing.

To mount the 702T to a computer via FireWire:

1. Stop all playback and recording activity.
2. Interconnect the 702T to a FireWire-enabled computer using an appropriate FireWire cable. No drivers are required if the computer meets the requirements listed in Specifications.
3. Make certain that within the **FIREWIRE: CONNECTION** setup menu option **COMPUTER/CONNECT** has been selected.

4. The 702T will now show the screen below when successfully connected via FireWire. When connected, all audio functionality of the 702T is defeated.

5. Navigate the drives on the computer and copy all needed audio to local storage.

To avoid possible corruption of CompactFlash medium, always properly dismount the 702T from the operating system. On Mac platforms, drag the drive icons to the trash. On Windows platforms, use the "Disconnect External Media" icon in the system tray.

To disconnect the 702T from FireWire:

1. Make certain that any software applications referencing the 702T are closed and that all file copy functions to and from the 702T have been completed.

2. In Mac OS X highlight the drive icon on the desktop and select ⌘-e to eject the volume. Alternatively, drag the drive icon to the trash in the dock.
2. In Windows, right-click the drive icon and select "eject."
3. The cable between the computer and 702T can now be disconnected. If a future connection is going to be made the cable can be left connected.

If the 702T is disconnected from the computer via an eject command and the FireWire cable is still physically connected between the computer and recorder, the data connection can be made by entering the Setup Menu select **FIREWIRE: CONNECTION**. Alternatively, press the STOP button and HDD button together to begin a FireWire connection.

Do not remove the CompactFlash card while **FIREWIRE CONNECTION** *appears in the LCD.*

Powering

The 702T is powered from either removable, Li-ion rechargeable batteries or external DC power. The included, removable 7.2 V Li-ion cell can be used as a primary or backup power source. The 702T automatically chooses the power source based on the voltage level of the external power supply. If it falls below a factory-set threshold, the unit will transition to Li-ion power. The transition between external and removable battery powering is seamless and has no affect on recording or playback operation.

During typical operation the 702T will run for approximately two hours from the included 1500 mAh Li-ion battery.

Lithium Ion Rechargeable Battery

The 702T is compatible with Sony-mount L- or M-type Li-ion rechargeable batteries. Numerous power capacities are available in these battery types, ranging from 1000 mAh to 7000 mAh. The 702T's mount accommodates unlimited battery depth. Larger amp-hour cells provide more run time.

When powered by the removable Li-ion battery the LCD displays the battery voltage. The nominal operating voltage for Li-ion batteries is 7.2 V, with operating voltages ranging between 6.5–8.5 V. When the battery drops to 6.5 V, the LCD voltage display and the power LED begin flashing to warn that the battery is nearly depleted. When the voltage reaches 6.3 volts the 702T will power down—any recordings in-process will automatically be closed (stopped).

External Powering and Battery Charging

The 702T can be powered externally from 10–18 VDC (2 amp minimum). External DC fully powers the unit and charges an attached Li-ion battery simultaneously using the 702T's onboard Li-ion charger. The charger circuit operates whenever the unit is powered on and optionally when the unit is off, depending on the external power wiring (*see below*).

DC input uses a 4-pin Hirose connector (Part # HR10-7P4P). There are two connection options available:

External DC Input Wiring	Operation
pin-2 to negative (–) pin-3 to positive (+)	operates the on-board Li-ion charger when the unit is both turned on and off. Use when plugged into AC power
pin-1 to negative (–) pin-4 to positive (+)	operates the on-board Li-ion charger only when the unit is turned on—there is no external current draw when powered off. Use when connecting to an external battery pack

Regardless of whether pins-1 and -4 or pins-2 and -3 are used, the unit will always charge the Li-ion battery when the unit is powered on.

Pin-1 and pin-2 of the external DC input are at the same ground potential as chassis and signal ground.

The voltage level of the source powering the unit is displayed on the main LCD screen in the upper left-hand corner (EXT 12.0V). When the 702T senses a low voltage condition from an external DC source the power LED and battery voltage display flashes, to alert the user. When the external DC reaches 9 volts, the 702T will automatically switch over to the removable battery. If no battery is installed the unit will shut down.

The included AC-to-DC power supply operates the unit and charges the removable batteries simultaneously. Pins-3 and -4 are wired to (+) and pins-1 and -2 are wired to (–).

When power is applied, the charging circuit evaluates the battery condition and supplies charging current, if necessary. When charging, the amber charge LED will flash. Once the battery is fully charged, the charger will turn off and the amber charge LED will light solid, indicating a full charge. Large capacity cells increase the charge time.

Charge LED Activity	Description of Activity
Off	Charger disabled
On	Completed charge / battery fully charged
Blinking	Charger enabled / battery is charging

If the charge LED shows anything but a successful charge, the Li-ion battery may require replacement.

Time Code Clock Battery

The 702T has an internal NiMH LR6 (AA) battery to power to the time code generator circuitry and time-of-day clock. This battery is charged simultaneously with the Li-ion battery. Additionally, the AA is charged from the Li-ion battery when the unit is powered on.

With a fully charged AA battery, accurate time code is held for two hours after power down. The 702T can be powered down and the removable battery can be removed and replaced without worry of time code jumps or inaccuracy. When the NiMH battery reaches a factory-set voltage, the time code generator will shut off and the time-of-day clock will take over — holding time and date for up to 60 days.

702T maintains accurate time code for 2 hours after power-down with a fully charged NiMH battery time code AA battery, even with the Li-ion and external DC power sources removed.

Auto Functions with External Powering

The 702T can perform several functions when DC power is applied to and removed from the recorder. Options available include:

- **Power on unit** – unit will turn on and be ready for operation.
- **Power on and begin recording** – unit will power on and begin recording with the settings used when previously powered down.
- **Power on, power off unit** – external DC functions as the on/off switch.
- **Power on and begin recording, power off** – unit will power and begin recording, then turn off when power is removed.

These functions are useful when the unit is part of a production kit powered by a single power source. A single power switch can be used to power on the whole kit.

In addition to the internal record timer, the auto functions (power on/begin record/power off) can be used for more extensive unattended recording control. Using an outboard timer attached to a DC supply the 702T can be placed and activated to record events including SFX or nature, and for surveillance applications.

Pin-3 (+) of the external DC input must be wired in order for the External Power Functions to operate.

Power-up Messages

This Setup Menu option provides a choice of whether or not the 7-Series displays messages upon boot up. It is best practice to set **POWER: POWER-UP MESSAGES** to disabled when using the external power functions to activate recording. This prevents power up messages, such as daily folder prompts, output attenuation notices, and time and date setting notices, from prohibiting the 7-Series from beginning a recording

Power Consumption Variables

The 702T draws power from either its on-board Li-ion battery or from external DC sources. Two factors need to be considered to calculate battery runtime—battery/power supply capacity and unit power consumption. The best determination of your run time is to experiment with a given recording setup.

The 702T power consumption varies over a range between 4 W to 20 W (12 volts), depending on active functions. The following functions have the most significant affect on power consumption:

Inputs	Active analog inputs increase power consumption. If recording from digital sources, disable analog inputs, or inputs altogether to reduce power consumption. If recording solely to inputs 1 and 2, disable inputs 3 and 4 to reduce power consumption. Analog inputs and the microphone preamps draw current whether they are idle or active. Active inputs draw 1.5 W compared to deactivated inputs.
Microphone Powering	Phantom powered microphones draw power for operation. Up to 1 W can be drawn from the phantom supply.
Battery Chargers	Depending on the charge state of the on-board Li-ion and the internal AA time code battery, the charging circuit can draw ~10 W from external DC.
Sampling Rate	The 702T draws more power at higher sampling rates. Each doubling of the sampling rate adds ~1 W of power consumption.

Firmware Upgrades

The 702T uses upgradable EEPROM (electrically erasable programmable read-only memory) to hold the unit's operating system software, or firmware. Firmware is the source code which controls all aspects of the device, including: menu options, signal routing, signal processing, LED's, button and switches, and data ports.

Version Information

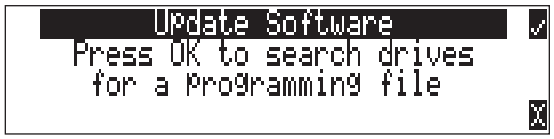
During manufacturing the unit's hardware revision number and serial number are burned into a protected area of the EEPROM and are not changeable. These numbers can be viewed from the **INFO:VERSION** selection of the Setup Menu. **INFO:VERSION** also shows the firmware version of the recorder.

The current firmware revision number is also displayed on the bottom right-hand corner of the Sound Devices splash screen at boot up (v2.65+). The 702T firmware version and unit serial numbers are written to the data chunk of every WAV audio file generated by the 702T.

Upgrading Firmware

From time to time Sound Devices may issue revisions (new versions) of firmware for the 702T. Firmware is user-upgradeable. To upgrade firmware follow the steps below.

1. Download the firmware file from the Sound Devices web site.
2. Transfer the firmware file (it will be named **VERSION _ NUMBER.PRG**) to a CompactFlash card in the 702T via FireWire. If there are multiple firmware files on the media, the 702T will indicate the firmware file listed to apply. To prevent confusion, ensure that there is only one firmware file available on either 702T media.
3. Enter the firmware upgrade menu. You will be prompted to search for the firmware file. If a valid firmware file is present on the CF card the recorder will prompt if the path is the proper file to use. Press the Rotary Switch or the tone button to say yes. The 702T will begin firmware upgrade and validation. Progress is indicated with a bar graph.



4. When the upgrade and verify process is complete, power cycle the 702T. On power-up the LCD will turn solid black and the green LED next to the FireWire port will blink 20 times. When the update sequence is complete, the 702T will reboot once again.
5. Verify the firmware version using the **INFO:SOFTWARE** menu.
6. Reset the time-of-day clock, time code generator, and verify any recording parameters.
7. It is best practice to download the latest user guide from the Sound Devices web site, since the changes to functionality are documented.

Firmware upgrades usually preserve all user menu settings. However, save a snapshot of the settings to a setup file on the CF. Once a firmware upgrade is complete, restore settings from this file, if necessary. Some firmware updates may make changes to user setups; verify all user setups after an upgrade.

CL-1 Remote Control and Keyboard Interface

The CL-1 Remote Control and Keyboard Interface is an available, optional hardware accessory to interface the recorder with PS/2 compliant computer keyboards and enables external devices to control the 702T. When using the CL-1, front panel controls and menu selections on the 702T can be mapped to keyboard shortcuts, allowing for full keyboard control of the recorder. Additionally the CL-1 has contact closures for programming remote inputs or outputs. These are commonly used for machine control and "remote rolling" using a mixing console with transport controls.

Connecting the CL-1

1. Connect the included C. Link cable to the 702T's C. Link Input connector.
2. Connect the opposite end of the C. Link cable to the CL-1's C. Link connector.
3. Connect a PS/2 keyboard to the PS/2 connector on the CL-1.
4. Connect switches between assigned pins 1-6, pin-7 (ground), and pin-8 (+5V) on the CL-1. (See *Logic Inputs and Outputs*)

The C. Link port on the 702T provides power for CL-1 operation.

Keyboard Assignments

Standard keyboard shortcuts have been pre-assigned and are listed below.

Menu Keys

Shortcut Key	Function
Space Bar	Enters Playback Mode Pauses the take in Playback Mode
Escape	Cancel – Exits without saving in all menus
Enter	Ok – Exits with saving in all menus (Check Mark or Edit)
Up Arrow	Mirrors the LCD Up Arrow in all menus
Down Arrow	Mirrors the LCD Down Arrow in all menus
Left Arrow	Mirrors the LCD RWD Arrow in all menus Custom Route User Interface – Un-assign Route Time Menu – Moves to previous field
Right Arrow	Mirrors the LCD FFWD Arrow in all menus Custom Route User Interface – Assign Route. InRoute User Interface – Edit if on 'Custom Route' File User Interface – Selects Options for Folders/Files when displayed Shortcut Edit User Interface – Edit shortcut if on shortcut number Scene/Track Lists – Edits (Same as hitting Play button) Time Menu – Moves to next field.
Menu	Enters the Setup Menu
CTRL + Up Arrow	Setup User Interface Menu - Moves to the previous category
CTRL + Down Arrow	Setup User Interface Menu - Moves to the next category
Page Up	Setup User Interface Menu - Moves to the previous category or marker
Page Down	Setup User Interface Menu - Moves to the next category or marker Shortcut Edit User Interface Menu – Same as Enter
Home	Setup User Interface Menu - Moves to the top of the list. File User Interface – Moves to the top of the list Shortcut Edit User Interface – Goes to first shortcut number or Hot Key String User Interface – Goes to the beginning of the string

End	Setup User Interface Menu - Moves to the bottom of the list. Shortcut Edit User Interface – Goes to last shortcut number or Hot Key String User Interface – Goes to the end of the string being edited
Delete	Scene/Track Lists – Deletes entry when permitted String User Interface – Deletes character when permitted
Insert	Setup User Interface Menu - Toggles Markers String User Interface – Inserts a space when permitted
Custom Assignment "Hot Key"	Shortcut Edit User Interface Menu - Selects Hot Key In Set Key Mode Global - Executes Command if function is assigned to Hot Key
01 - 99 (number sequence)	Setup User Interface Menu – Jumps to menu list number. Shortcut User Interface Menu – Jumps to shortcut number.

String Edits & Take Name/Number (Renaming & Notes)

Hot Key	Function
ASCII Characters	Scene – Prints Character and moves to next character. Take – '0-9' – Prints Number, 'A-Z' – Prints Spacer
Backspace	Deletes previous character and moves one character to the left
Delete	Deletes currently selected character Take – Same as 'Reset' (Play Button)
Enter	Carriage Return if permitted, otherwise Ok – Exits with saving
CTRL + Enter	Ok – Exits with saving. (Only when Carriage Return is permitted.)
Insert	Inserts a space when permitted
Escape	Cancel – Exits without saving in both menus
Up Arrow	Increment Character in both menus
Down Arrow	Decrement Character in both menus
Left Arrow	Previous Character in both menus
Right Arrow	Next Character in both menus
Home	Goes to the beginning of string being edited
End	Goes to the end of the string being edited

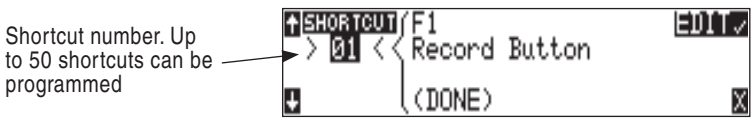
Assignable Shortcuts

Keyboard shortcuts can be programmed to control nearly every function on the 702T. Shortcuts can select and change menu items with a simple key strokes. Combinations of computer keyboard function keys, along with Control-, Alt-, and Shift- can also be programmed. The following chart shows what keys are programmable.

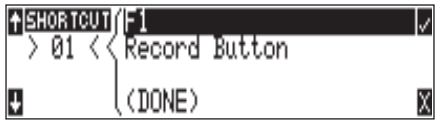
Hot Key	Key	Shift-	Ctrl-	Alt-
F1-F12	X	X	X	X
0-9	-	-	X	X
A-Z	-	-	X	X
Logic In 1-6	X	-	-	-

To program a shortcut perform the following steps:

1. Enter the External Keyboard Assignment Setup Menu selection.



2. Select an unassigned shortcut number for programming. If a duplicate key sequence is selected the lowest shortcut number action takes place. The example below shows the F1 key being reprogrammed.



3. After selecting a key sequence select the desired Setup Menu item or action. The example below shows the reprogramming of the F1 key to change the sampling rate to 48048.

Specific Setup Menu options can be programmed if multiple options are available.

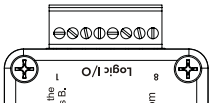
If a single key or key combination is programmed for multiple shortcuts, the shortcut with the lowest number will take precedence.

Shortcut List Functionality

The shortcut list is a user definable list of keyboard keys/Logic In that perform specified actions. The actions that a keyboard key can perform are listed in the below table. Macros are currently not implemented.

Action	Function
Momentary Button	Logic In only. Simulates selected button. Can simulate in any menu
Toggle Button	Logic In only. Toggles state of selected button. Play and Record are supported
Open Menu	Opens a SetupUI Menu
Cycle Settings	Cycles a SetupUI parameter to the next setting and saves it
Set Settings	Sets a SetupUI parameter to the given setting and saves it
Open Time Code Menu	Opens the TimeCode: Jam Menu and goes to the given parameter
Jam Time Code Item	Jams given TimeCode parameter
Edit Time Code Item	Opens the TimeCode: Jam Menu Edit screen for the given parameter
Button Shortcuts	Simulates a front panel button shortcut. Ex: (Stop+Play) opens TakeList Menu

Logic Inputs and Outputs



Identical to shortcuts assigned to computer keyboard key sequences, the CL-1 has six contacts that can be programmed to perform Setup Menu items or control the record, play, and stop functions of the recorder. A switch connected between the assigned pin and ground (pin-7) will form a circuit. Closing the circuit will activate the programmed action.

The Logic pins on the CL-1 can be set individually as either a switch-closure input or a switch closure output. The inputs and outputs are “logic low” devices, meaning that to turn “on” an input, it must be connected to ground (zero volts). Likewise, when an output is “on”, it puts out 0 volts and when it is “off”, it puts out +5 volts.

Logic Inputs

Configured as a switch-closure input, a pin can be connected to a switch that a user has wired to assigned contact. This switch can then trigger the 702T to begin recording. Other functions can be assigned as well from the Setup Menu. The switch-closure on a given pin of the CL-1 can be thought of as just another key on the keyboard. Anything that can be assigned to a key can also be assigned to a switch.

To configure a pin as an input, navigate to **EXT KEYBOARD ASSIGN** in the Setup Menu. Select a new **SHORTCUT** number, then locate the Login inputs amongst the assignable keys. Choosing **LOGIC IN 1** would correspond to pin 1 on the CL-1, **LOGIC IN 2** would correspond to pin 2 on the CL-1, and so on. After a Logic input is chosen assign the desired action that the Logic input will control.

Logic Outputs

Configured as a switch-closure output, the CL-1 can drive LEDs, relays, or any other sort of device which will accept a TTL-level or similar input. For example, the CL-1 can drive a big red LED connected via a series resistor between the +5V output and a switch-closure output and light up whenever the recorder is put into record mode.

To configure a pin as an output, go to **CL-1: LOGIC OUT ASSIGN** in the Setup Menu. The Logic Pin number is on the left hand side ("00", "01", etc). Each of these pins can be assigned to undefined, Stop, Play, Record, or Pause. Note that if a pin is assigned to be both an input (via the **EXT KEYBOARD ASSIGN** Setup Menu) and an output (via the **CL-1: LOGIC OUT ASSIGN** Setup Menu), the pin will automatically default to an output.

Setup Presets

Presets are useful shortcuts to speed setting the numerous parameters available in the Setup Menu. The 702T has four built-in presets and unlimited user presets.

Built-In Presets

The 702T is shipped from the factory with the factory preset applied. Its settings are listed below. Three additional presets, film, reporter, and music presets allow for quick setup of typical parameters for the defined application. Presets are applied by entering the Setup Menu and selecting the preset. All previous settings are lost when a preset is applied.

702T Presets	Factory Preset	Film Preset	Reporter Preset	Music Preset
Rec: FireWire Connection	External Drive	External Drive	Computer Connect	Computer Connect
Rec: Sampling rate	48 kHz	48 kHz	44.1 kHz	44.1 kHz
Rec: Bit Depth	24 bits	24 bits	16 bits	16 bits
Rec: File Type	.wav poly	.wav poly	.wav mono	.wav poly
Rec: Media Select	EXHDD and CF	EXHDD and CF	CF only	CF only
Rec: Scene Name/Number	None	None	None	None
Rec: Track Names	Track A: Track A Track B: Track B	Track A: Track A Track B: Track B	Track A: Track A Track B: Track B	Track A: Track A Track B: Track B
Rec: Take Name/Number	T 01	T 01	T 01	T 01
Rec: Take Reset Mode	When Scene is changed	When Scene is changed	When Scene is changed	When Scene is changed
Rec: Pre-Roll Time	2 Sec	2 Sec	2 Sec	2 Sec
Rec: Dither	Off	Off	On	On

702T Presets	Factory Preset	Film Preset	Reporter Preset	Music Preset
Rec: Timer Start	Disabled	Disabled	Disabled	Disabled
Rec: Timer Stop	Disabled	Disabled	Disabled	Disabled
Rec: Record Indicator	Normal Numbers	Normal Numbers	Normal Numbers	Normal Numbers
Rec: Record Pause	Disabled	Disabled	Disabled	Disabled
Input: Routing	1->A / 2->B	1->A / 2->B	1->A,B / 2->A,B	1->A / 2->B
Input 1: 48V Phantom	Off	On - Mic	On - Mic	On - Mic
Input 2: 48V Phantom	Off	On - Mic	On - Mic	On - Mic
Mic Inputs: Limiter	Enabled	Enabled	Enabled	Enabled
Mic Input 1: Low Cut	Disabled	Disabled	Enabled	Disabled
Mic Input 2: Low Cut	Disabled	Disabled	Enabled	Disabled
Mic Input 1: Low Cut Frequency	40 Hz, 12 dB/oct	40 Hz, 12 dB/oct	40 Hz, 24 dB/oct	40 Hz, 12 dB/oct
Mic Input 2: Low Cut Frequency	40 Hz, 12 dB/oct	40 Hz, 12 dB/oct	40 Hz, 24 dB/oct	40 Hz, 12 dB/oct
Mic Input 1: Gain Range	Normal	Normal	Normal	Normal
Mic Input 2: Gain Range	Normal	Normal	Normal	Normal
Input 1,2: Source	Auto Select	Auto Select	Auto Select	Auto Select
Input 1,2: Linking, MS	Unlinked	Unlinked	Unlinked	Linked 1,2
Line Input 1,2: Gain Ctrl	Use Front Panel Knobs	Use Front Panel Knobs	Use Front Panel Knobs	Use Front Panel Knobs
Input 1: Delay	0 mS	0 mS	0 mS	0 mS
Input 2: Delay	0 mS	0 mS	0 mS	0 mS
File: Marker Mode	New File	New File	New File	New File
File: Max Size	2G CF (1.8 GB)	2G CF (1.8 GB)	2G CF (1.8 GB)	2G CF (1.8 GB)
File: Folder Options	None	None	None	None
File: Copy Files	Copy all CF> EXHDD	Copy all CF> EXHDD	Copy all CF> EXHDD	Copy all CF> EXHDD
File: Copy Flag Reset	Enabled	Enabled	Enabled	Enabled
Time Code: Frame Rate	30	30	30	30
Time Code: Mode	Free Run	Free Run	Off	Off
Time Code: Mode	2.0 sec	2.0 sec	2.0 sec	2.0 sec
Time Code: User Bits	mm:dd:yy.tt	mm:dd:yy.tt	Not Used	Not Used
Time Code: Jam Menu	Jam RX TC	Jam RX TC	Jam RX TC	Jam RX TC
Time Code: Display Mode	Big A-time	Big A-time	Big A-time	Big A-time
Output1 Left: Source	Track A	Track A	Track A	Track A
Output1 Right: Source	Track B	Track B	Track B	Track B
Output1 L,R: Attenuation	0 dB	0 dB	0 dB	0 dB
Output2 Left: Source	Track A	Track A	Track A	Track A
Output2 Right: Source	Track B	Track B	Track B	Track B
Output2 L,R: Attenuation	0 dB	0 dB	0 dB	0 dB
Digital Output: Mode	Consumer	Consumer	Consumer	Consumer
Play: AutoPlay Mode	Play All	Play All	Play All	Play All
Time/Date: 12/24 Hr	12 Hr	12 Hr	12 Hr	12 Hr
Time/Date: Date Format	MM/DD/YY	MM/DD/YY	MM/DD/YY	MM/DD/YY
LCD Contrast	50%	50%	50%	50%
LCD: Gain Display	Bit Depth, SR & Gain	Bit Depth, SR & Gain	Bit Depth, SR & Gain	Bit Depth, SR & Gain
LCD: Scrolling Direction	Normal	Normal	Normal	Normal
Meter: Ballistics	Peak Hold + VU	Peak Hold + VU	Peak Hold + VU	Peak Hold + VU
Meter: Peak Threshold	0 dBFS	0 dBFS	0 dBFS	0 dBFS
Meter: Stealth Mode	Off	Off	Off	Off

702T Presets	Factory Preset	Film Preset	Reporter Preset	Music Preset
HP: Rotary Sw Function	Selects Favorite Mode	Selects Favorite Mode	Selects Favorite Mode	Selects Favorite Mode
HP: Monitor Modes	01> Inputs 1,2 02> Tracks A,B 03> Input 1,1 04> Input 2,2 05> Monitor A,B	01> Inputs 1,2 02> Tracks A,B 03> Input 1,1 04> Input 2,2 05> Monitor A,B	01> Tracks A,B	01> Inputs 1,2 02> Tracks A,B 03> Input 1,1 04> Input 2,2 05> Monitor A,B
HP: Favorite Mode	Tracks A,B	Tracks A,B	Tracks A,B	Tracks A,B
HP: Playback Mode	Tracks A,B	Tracks A,B	Tracks A,B	Tracks A,B
HP: Warning Bell	-30 dBFS	-30 dBFS	-30 dBFS	-30 dBFS
HP: Record/Stop Bell	Disabled	Disabled	Disabled	Disabled
Tone: Level	-20 dBFS	-20 dBFS	-20 dBFS	-20 dBFS
Tone: Frequency	1000 Hz	1000 Hz	1000 Hz	1000 Hz
Tone: Mode	To Rec Tracks and Outputs	To Rec Tracks and Outputs	To Rec Tracks and Outputs	To Rec Tracks and Outputs
Tone: Record Lock	Locked while Recording	Locked while Recording	Locked while Recording	Locked while Recording
CF: Empty Trash	Empty Trash	Empty Trash	Empty Trash	Empty Trash
EXHDD: Empty Trash	Empty Trash	Empty Trash	Empty Trash	Empty Trash
Power: Ext Low Batt Volt	11.0 volts	11.0 volts	11.0 volts	11.0 volts
Power: Ext Power Function	Do Nothing	Do Nothing	Do Nothing	Do Nothing
Power: Power-up Messages	Enabled	Enabled	Enabled	Enabled
Ext Keyboard: Assign	F1 > Record F2 > Stop Button F5 > Rewind Button F6 > Play Button F7 > Fast Forward Button CTRL + C > File: Copy Files Last 24Hr CF > EXHDD	F1 > Record F2 > Stop Button F5 > Rewind Button F6 > Play Button F7 > Fast Forward Button CTRL + C > File: Copy Files Last 24Hr CF > EXHDD	F1 > Record F2 > Stop Button F5 > Rewind Button F6 > Play Button F7 > Fast Forward Button CTRL + C > File: Copy Files Last 24Hr CF > EXHDD	F1 > Record F2 > Stop Button F5 > Rewind Button F6 > Play Button F7 > Fast Forward Button CTRL + C > File: Copy Files Last 24Hr CF > EXHDD
Ext Keyboard: Langauge	English	English	English	English
CL-1: Re-Program	CL-1 Module	CL-1 Module	CL-1 Module	CL-1 Module
CL-1: Logic Out Assign	(Undefined)	(Undefined)	(Undefined)	(Undefined)

User Setup Data File

All of the set parameters in the table above can be saved to a date file on the CompactFlash card. By entering the Get/Save Setup Menu, the user can save or restore parameters to and from this data file. This binary file is named **`702T.SUP`** and is saved in the **`SOUNDDEV`** folder on the CompactFlash card

Setup Menu

The chart below describes the available setting for the 702T.

#	Setup Name	Setup Description	Setup Options
1	**Quick Setup**	Allows the user to quickly apply default menu setups and save/retrieve user setups to disk or CF.	• Load Factory Settings - restores the factory default settings • Load Film Settings - applies typical setups for film production • Load Reporter Settings - applies typical setups for voice recording • Load Music Settings - applies typical setups for music recording • Load User from CF - applies settings saved by user to CF • Save User to CF - saves present state to file on CF
2	**FireWire: Connection**	Activates FireWire drive mode.	• Computer/Connect (STOP+HDD buttons) • External Drive
3	**Rec: Sample Rate**	Sets the audio sampling frequency of the 702T	• 32 kHz • 44.1 kHz • 47.952 kHz • 47.952k F • 48 kHz • 48.048 kHz • 48.048k F • 88.2 kHz • 96 kHz • 96.096 kHz • 96.096 k F • 176.4 kHz • 192 kHz
4	**Rec: Bit Depth**	Sets the bit depth of the 702T recordings.	• 16 bit, • 24 bit
5	**Rec: File Type**	Selects the file format (type) recorded to the selected medium.	• .wav poly • .wav mono • .flac • .MP3 32 kb/s • .MP3 64 kb/s • .MP3 96 kb/s • .MP3 128 kb/s • .MP3 160 kb/s • .MP3 192 kb/s • .MP3 256 kb/s • .MP3 320 kb/s • .MP2 64 kb/s • .MP2 96 kb/s • .MP2 128 kb/s • .MP2 160 kb/s • .MP2 192 kb/s • .MP2 256 kb/s • .MP2 320 kb/s • .MP2 384 kb/s
6	**Rec: Media Select**	Selects the storage media used for recording. Media is selectable even if it is not present.	• CF Only • EXHDD Only • EXHDD and CF
7	**Rec: Scene Name/Number**	User-defined, alpha-numeric file scene names can be pre-set and selected from a list. Scene name lists can be saved to hard drive.	<up to 9 alpha-numeric characters can be entered for the scene name> Scene name can also be left blank
8	**Rec: Track Names**	used to identify a track name which shows up in iXML and BWF metadata	• Track A • Track B • Track C • Track D • Mix • Boom • <Add New Entry> • <Load List From CF> • <Save List From CF>
9	**Rec: Take Name/Number**	Numeric, auto-incrementing number used for take identification.	<selectable alpha character + integers up to 32000, with or without preceding 0's>
10	**Rec: Take Reset Mode**	Defines when take numbers are reset. Reset brings take number to <1>.	• Never - take numbers do not reset • When scene is changed - take resets when scene name is changed • When daily folder changes - takes reset on new day • Either scene or daily - takes reset on either change

#	Setup Name	Setup Description	Setup Options
11	**Rec: Pre-Roll Time**	Selects the amount of pre-roll time the 702T will add to the beginning of each file.	0–10 sec. @ 48 kHz 0–5 sec. @ 88.2–96.096 kHz 0–2 sec. @ >96.096–192 kHz
12	**Rec: Dither**	Selects whether to dither is added to 24 bit digital signals while recording 16 bit files.	• Off • On (16 bit only)
13	**Rec: Timer Start**	Sets a specific start time/date for unattended recording. Unit must be powered.	<enter time, date>
14	**Rec: Timer Stop**	Set a specific time/date to stop recording. May be used with or without the Rec: Timer Start. May be set before the Timer Start time to temporarily stop recording and then resume recording with Timer Start.	<enter time, date>
15	**Rec: Record Indicator**	Sets how the large display looks when the unit enters record.	• Normal Numbers • Reverse Numbers • Flash Numbers
16	**Rec: Record Pause**	Allows a recording to be stopped then continued without creating a new take or file. Time Code Mode must be set to Off to enable Record Pause.	• Disabled • Enabled
17	**Input: Routing**	Allows the user to setup their routing matrix among all available inputs and tracks. There are preset routings and three custom routings available. Pressing the input select key repeatedly will cycle through all preset routings. Primarily accessible from the Input Select Key.	• 1 → A • 1 → A / 2 → B • 1 → A / 1 → B • 1 → A,B / 2 → A,B • Custom Route 1 • Custom Route 2 • Custom Route 3
18 19	**Input 1: 48V Phantom** **Input 2: 48V Phantom**	Enables or disables 48 V phantom power on inputs 1 and 2.	• Off • On - Mic • On - Mic and Line
20	**Mic Inputs: Limiter**	Enables or disables the analog input limiter on input 1 and 2 mic preamps.	• Disabled • Enabled
21 22	**Mic Input 1: Low Cut** **Mic Input 2: Low Cut**	Enables the high-pass (low cut) filter to reduce sensitivity to low frequencies.	• Disabled • Enabled
23 24	**Mic Input 1: Low Cut Freq** **Mic Input 2: Low Cut Freq**	Selection of twelve high-pass filter frequency and slope combinations for microphone inputs.	• 40, • 80, • 160, • 240 Hz @ 12 dB/oct • 40, • 80, • 160, • 240 Hz @ 18 dB/oct • 40, • 80, • 160, • 240 Hz @ 24 dB/oct
25 26	**Mic Input 1: Gain Range** **Mic Input 2: Gain Range**	Selects the sensitivity of the microphone input. Low sensitivity is used for very loud and/or very hot microphones.	• Normal • Low • Normal, fades to off • Low, fades to off
27	**Input 1, 2: Source**	Forces the inputs to analog or digital mode. Default is auto-select.	• Auto-select • Analog • Digital (S/PDIF/AES) • Disabled (Power Save)
28	**Input 1,2: Linking, MS**	Selects whether the input 1 & 2 levels are controlled independently or grouped as a pair with or without mid-side decoding.	• Unlinked Inputs 1 and 2 operate independently • Linked 1/2 Inputs are linked, channel 1 pot controls level, channel 2 pot controls pan • Linked 1/2 and MS Inputs are linked, channel. 1 pot controls level, channel. 2 pot controls pan and are decoded for MS stereo.
29	**Line Input 1,2: Gain Control**	When inputs 1 and 2 are in LINE input mode, selects whether the gain setting is controlled by the front panel knobs or by the menu sensitivity settings below.	• Use front panel knobs • Use sensitivity settings

#	Setup Name	Setup Description	Setup Options
30 31	**Line Input 1: Gain** **Line Input 2: Gain**	Adjusts the input sensitivity in 0.1 dB steps –6 dB and +18 dB.	Meters show a pre-fader level of the input signal of all four inputs on their respective meters to aid in the adjustment.
32 33	**Input 1: Delay** **Input 2: Delay**	Sets a digital delay for each input. Can be used to compensate for delay in various digital wireless microphone units or digital processors.	0 to 30 milliseconds, 0.1 mS increments 0 mS to 30,000 mS up to 48.048 kHz Fs 0 mS to 15,000 mS up to 96.096 kHz Fs 0 mS to 7,500 mS up to 192 kHz Fs
34	**File: Marker Mode**	Enables the user to set cue points on the fly while recording by pressing the record key.	• Markers Disabled No cue marks are set. • New Cue Cue markers will be set within one contiguous file. • New File A new file is started with each press of the record key, the take counter is increased by one.
35	**File: Max Size**	Selects the file size where the 702T will close, then start a new file. The 702T will not record a file larger than the selected size. The largest file permissible with the 702T's FAT32 file system is 4 GB	• 4 GB CF (3.6 GB) • 2 GB CF (1.8 GB) • 1 GB CF (950 MB) • 512MB CF (450 MB)
36	**File: Folder Options**	Allows user to organize files in root and sub-folders. To not use any folders select <None> on every level.	• TOP-LEVEL <None>, <Add new entry> • MID-LEVEL <None>,<Add new entry>, <Daily> • BOTTOM-LEVEL <None>, <Add new entry>, <Scene>
37	**File: View Files**	Enters the file directory tree for the selected drive.	Highlight media descriptor to navigate the menu
38	**File: View Take List**	Allows user to view the last 200 takes. Takes can be selected and converted to circle takes.	• Circle
39	**File: Copy Files**	Allows the user to select a file or a range of files to be copied from one storage media to another. Files will only be copied from their current directory to a directory of the same name on the other media. If a file will not fit on the destination media, user is given the option to skip that file and continue with the copy or abort the copy all together. User is advised at the end of the copy process how many files were copied successfully.	• Copy all {drive} → {drive} • Last 24 hr {drive} → {drive} • Last 48 hr {drive} → {drive} • Flagged {drive} → {drive} *All files, when recorded, automatically have their flag bit set to "on"*
40	**File: Copy Flag Reset**	Selects whether the flag bit is cleared or not on files copied from one media to another.	• Disabled • Enabled
41	**Time Code: Frame Rate**	Sets the time code frame rate. All common time code frame rates are available.	• 23.976 – used with high definition video cameras • 24 – to sync audio to film where no transfer to NTSC video is expected • 25 – to sync sound to PAL video • 29.97 – to sync sound to NTSC video shot in non-drop frame mode • 29.97DF - to sync sound to NTSC video shot in drop frame mode • 30 – to sync sound to film where transfer to NTSC video is expected • 30DF – to sync sound to film for transfer to NTSC video in drop-frame mode • 30+ – Records at 48.048 sampling rate at 30 frames per second but stamps the file at 48kHz, 30 frames per second

#	Setup Name	Setup Description	Setup Options
42	**Time Code: Mode**	Sets the mode for the time code generator	• Off – time code not active, recorded or output • Free Run – time code is initialized from the jam menu and then runs continuously regardless of record mode • Free Run Jam Once – time code is initialized from an external source and updates itself to the external source when reconnected • Record Run – time code is initially set from the jam value item in the jam menu. Time code generation runs only during recording generating continuous time code from file to file. • 24 Hr Run – time code is initialized from the system clock on startup and enters free run mode. Time code is updated if the time of day clock is adjusted. • Ext TC – applies external time code to the recorder directly. The internal time code generator has no effect. • Ext TC/cont – applies external time code to the recorder; internal generator continues to run if time code signal is lost. Useful for time code transmission over RF • Ext TC-Auto Record – applies external time code to the recorder. Unit enters Record when time code runs and stops when time code stops. • Ext TC/cont-Auto Record – applies external time code to the recorder; internal generator continues to run if time code signal is lost. Unit enters Record when time code runs and stops when time code stops.
43	**Time Code: Hold Off**	Sets the duration that a valid time code signal has to be recognized by the 702T before generating a new take while in Ext TC-Auto Record and Ext TC/cont-Auto Record modes.	0.0 to 8.0 seconds adjustable in increments of .1 seconds
44	**Time Code: User Bits**	Sets the time code user bits generated by the 702T. mm – month dd – day of week yy – year tt – take number uu – user-defined	• Not Used – user bits are not set or output • mm:dd:yy.tt • dd:mm:yy.tt • uu:uu:tt:tt – user bits are set to 4 user definable digits with 4 take digits • uu:uu:uu:uu • tt:tt:tt.tt – user bits are set to the take counter for all 8 digits • mm:dd:yy:uu • dd:mm:yy:uu
45	**Time Code: Jam Menu**	Allows the user to jam or edit the internal time code generator and user bits. (Also accessible by pressing HDD and Menu keys simultaneously).	• Jam RX TC – jams the internal generator to received external code • Jam Zeros – resets the internal generator to zero • Jam Value – sets the internal generator to the value set in edit value • Edit Value – allows to user to enter a free-form number to initialize the time code • Edit U-Bit – allows the user to edit allowed user bit numbers
46	**Time Code: Display Mode**	Sets the numbers of the large numerical display.	• Big A-time • Big time code

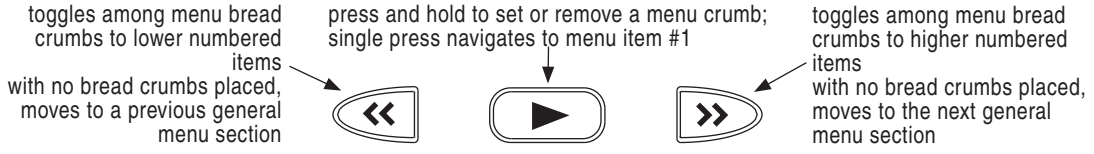
#	Setup Name	Setup Description	Setup Options
47 48	**Output 1 Left: Source** **Output 1 Right: Source**	Selects the signal source for the Master Output Bus (TA3 outputs and tape outputs.)	• Input 1 • Input 2 • Track A • Track B • Input 1+2 • Track A+B
49	**Output 1 L,R: Attenuation**	Selects the attenuation level of signal sent to the Master Output Bus.	Selectable from 0 to –40 dBFS
50 51	**Output 2 Left: Source** **Output 2 Right: Source**	Selects the signal source for output bus 2 sent to digital output bus 2.	• Input 1 • Input 2 • Track A • Track B • Input 1+2 • Track A+B
52	**Output 2 L,R: Attenuation**	Selects the attenuation level of the signal output to bus 2.	Selectable from 0 to –40 dBFS
53	**Digital Output: Mode**	Selects whether or not the consumer SPDIF bit is applied or not in the AES3id output.	• Consumer • Professional
54	**Play: AutoPlay Mode**	Allows user to play file(s) consecutively from selected directory, one time through or continuously. Great for playing an MP3 collection during down time!	• Disabled • Play all • Repeat one • Repeat all
55	**Time/Date: 12/24 Hr**	Selects between 12 hour and 24 hour time.	• 12 hr • 24 hr
56	**Time/Date: Date Format**	Selects the date syntax of the recorder.	• mm/dd/yy • dd/mm/yy
57	**Time/Date: Set**	Sets the internal date and time of the 702T. Resetting the time re-jams the internal time code generator to the set time. Setting the internal clock during a production day will require time code devices to be re-jammed.	<time, date> Clock is not set until <done> is selected
58	**LCD: Contrast**	Adjusts the contrast level of the LCD display.	0–100%
59	**LCD: Gain Display**	Sets the Main LCD Display to show the gain values of inputs 1 and 2 always or to show Bit Depth and Sample Rate and Gain of input 1 and 2 only when attenuated.	• Bit Depth, SR & Gain • Gain Only
60	**LCD: Scrolling Direction**	Defines the direction in which the Multi-Function Rotary Switch will navigate throughout the 702T.	• Normal • Reverse
61	**Meter: Ballistics**	Selects among five different meter ballistics settings	• VU only • Peak only • Peak-hold only • Peak+VU • Peak-hold + VU
62	**Meter: Peak Threshold**	User-set level in dBFS where track peak LED's illuminate. 0 LED doubles as track peak indicator.	0 to –20 dBFS (1 dB increments)
63	**Meter: Stealth Mode**	Enables LEDs to toggle on and off with the LCD backlight key.	• Off • On
64	**HP: Rotary Switch Function**	Selects the functionality of the Rotary Switch's button when in record and playback.	• Disabled: push makes no change to the headphone matrix. • Selects Favorite Mode: in record and playback modes, push will change the headphone source immediately to the favorite selected in HP: Favorite Mode. • Playback/Monitor Drive Select Selects the media source for file playback and record monitoring

#	Setup Name	Setup Description	Setup Options
65	**HP: Monitor Modes**	Select the sequence of the modes that appear in the Headphone Source Display on the LCD.	Up to 20 source selections can be entered in any order. See headphone monitor section in guide for adjustment and Favorite Mode below for list of headphone selections.
66	**HP: Favorite Mode**	Selects the audio source monitored when the Rotary Switch is pressed during recording or playback.	Inputs 1,2 Tracks A,B Monitor A,B Input 1,1 Input 2,2 Track A,A Track B,B Monitor A,A Monitor B,B Inputs 1,2 (MS) Tracks A,B (MS) Tracks A,B (MS) Inputs 1+2,1+2 Tracks A+B,A+B
67	**HP: Playback Mode**	Selects the audio source sent to headphones upon playback.	• No change • Same as options listed above
68	**HP: Warning Bell Level**	Set the output level of the multi-function warning bell.	Off, –60 to –12 dBFS in 1 dB steps
69	**HP: Rec/Stop Bell**	Alerts the user with one beep at the start of recording and two beeps when the recording is stopped	• Disabled • Enabled
70	**Tone: Level**	Set the output level of the reference tone	–40 to 0 dBFS in 1 dB steps
71	**Tone: Frequency**	Allows the user to set the frequency of the reference tone oscillator	100–10,000 Hz in 10 Hz steps
72	**Tone: Mode**	Select the destination of the reference tone or to disables it completely	• disabled • to record tracks only • to outputs only • to record tracks and outputs
73	**Tone: Record Lock**	Sets the Tone key to be either available or locked while in Record Mode.	• Enabled While Recording • Locked While Recording
74	**Drive: Speed Tests**	Performs a speed test on the CompactFlash media installed and external drives. Data transfer speed is measured in KB/s.	Caution: Drive test will disable processing and mute outputs for duration of test. Outputs will not return until test is exited.
75	**CF: Space**	Shows the drive file system, total size, and space remaining on connected CompactFlash medium.	
76	**CF: Erase / Format**	Formats installed CompactFlash medium Caution, while various PC utilities are able to recover files from re-formatted drives, once formatted, old audio data is not accessible by the 702T.	
77	**CF: Empty Trash**	Allows user to delete files previously sent to the trash as well as false takes.	• Empty Trash • Empty False Takes • Empty both
78	**EXHDD: Space**	Shows the drive file system, total size, and space remaining on connected Compact Flash medium.	
79	**EXHDD: Erase / Format**	Formats attached FireWire storage volume Caution, while various PC utilities are able to recover files from re-formatted drives, once formatted, old audio data is not accessible by the 702T.	

#	Setup Name	Setup Description	Setup Options
80	**EXHDD: Empty Trash**	Allows user to delete files previously sent to the trash as well as false takes.	• Empty Trash • Empty False Takes • Empty both
81	**Balance Cal**	Calibrates the center position of the input 2 pot when used as the balance control for MS recording.	Place balance control to center and press to select.
82	**Power: Ext Low Batt Volt**	Sets the warning voltage of the low battery alert with an external power source. Internal battery warning threshold is factory set.	10.0–18.0 VDC, 0.1 V steps
83	**Power: Ext Power Function**	Controls the behavior of the unit when power is applied to the external DC jack. Pin-3 (+) of the external DC input must be wired in order for the External Power Functions to operate.	• Do Nothing • Power On Unit • Power On and Start Record • Power On/Off unit • Power On/Off unit and Record
84	**Power: Power-up Messages**	Enables or disables the notifications that appear upon boot up (daily folder prompt, output attenuation notice, and set time and date message). Disabling these messages is useful when using the External Power Functions to power on and start recording and the Record Start and Stop Timer.	• Disabled • Enabled
85	**Ext Keyboard: Assign**	Enter to setup keyboard shortcuts when using the CL-1 keyboard interface	
86	**Ext Keyboard: Language**	Select the language of the keyboard attached to the CL-1.	• English • German • French
87	**CL-1: Re-program**	The CL-1 has its own firmware which is supplied from the 702T. This utility updates the CL-1 firmware.	
88	**CL-1: Logic Out Assign**	Each logic output pin can be assigned to go high when the unit is in the selected mode. Logic input overrides logic output selection.	• Undefined • Stop • Play • Pause • Record
89	**Info: Button Shortcuts**	An informative menu showing the available keyboard shortcuts.	
90	**Info: Version**	Shows the hardware revision, serial number, and firmware version of the unit.	
91	**Update Software**	Upgrade tool used to apply new firmware. It will search all connected storage for the firmware file and prompt to update.	

Setup Menu Shortcuts

The Setup Menu can be quickly navigated using the Rotary Switch to move up and down through the menu. Additionally, shortcuts, or "breadcrumbs" can be placed on often-used menu items. A breadcrumb is set by holding the play button when at a selected menu item. A small dot is shown to the left of the setup number. Any number of breadcrumbs can be set, but their utility is reduced with too many applied.


toggles among menu bread crumbs to lower numbered items
with no bread crumbs placed, moves to a previous general menu section
press and hold to set or remove a menu crumb; single press navigates to menu item #1
toggles among menu bread crumbs to higher numbered items
with no bread crumbs placed, moves to the next general menu section

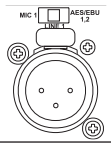
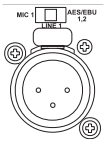
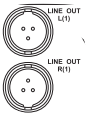
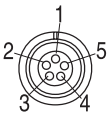
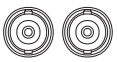
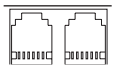
Front Panel Button Shortcuts

To speed navigation the 7-Series has numerous navigation "shortcuts". For combinations, hold down the first identified key and continue to hold while pressing the next keys.

Function	Key Sequence	Action
Record Tone	REC + ~	**Record and Tone** In the menu File: Marker Mode must be set to Markers Disabled. While recording hold the REC button and press the tone button. Tone will be active as long as the tone button is held.
Jam Menu	MENU + HDD	**Menu and HDD** Enters the time code jam menu. (702T &744T Only)
Button Lock	☼ + ~	**Backlight and Tone** Press backlight then tone to lock all front panel buttons except for Record, Stop and Play. FF and Rew are available in playback mode. Use backlight and tone again to unlock the panel.
Input Mutes	INPUT	**Input** Hold down and press soft buttons to mute inputs
Input Routing	■ + INPUT	**Stop and Input** Hold Stop and press INPUT to cycle through input routing presets. Last preset will open the input routing menu to the custom route selection
Phantom #1	~ + MENU	**Tone and Menu** Toggles input 1 phantom power. Phantom 1 & 2 are linked when Inputs 1 & 2 are linked.
Phantom #2	~ + HDD	**Tone and HDD** Toggles input 2 phantom power
Low-cut #1	☼ + MENU	**Backlight and Menu** Toggles Input 1 high-pass filter. Low-cuts 1 & 2 are linked when Inputs 1 & 2 are linked.
Low-cut #2	☼ + HDD	**Backlight and HDD** Toggles Input 2 high-pass filter
Connect FireWire	■ + HDD	**Stop and HDD** Initiates FireWire connection if previously disconnected via an "eject" command
Take Status Menu	■ + ☼	**Stop and Backlight** Enters Take Status Menu. From this menu mark the last recorded take as Circled or No Good.
False Take	■ + «	**Stop and Rewind** Delete last take prompt.
Increase Take	■ + »	**Stop and Fast Forward** Increments take number to be recorded for next file
Take List	■ + ▶	**Stop and Play** Take list and take status identifying screen
Toggle Drives	HDD	**HDD** Hold HDD button down for 1 second to toggle between viewable drives.
LED Level	☼ + Rotary Switch	**Backlight and Rotary Switch** Adjusts level of LED brightness.
Flashlight Mode	« + ▶ + ■	**Rewind and Play and Stop** With the power off, hold down these buttons while powering the unit to enter Flashlight mode. This illuminates all LEDs except for three. Press power again to exit.

Connector Pin Assignments

Each connector type, electrical characteristics, and pin assignment is shown below.

Connector		Pin Assignments	Notes
XLR (Analog Inputs)		1 – ground 2 – signal (+) 3 – signal (-)	7.5k ohm input impedance, mic level 20k ohm input impedance, line level active-balanced
XLR (AES Inputs)		1 – ground 2 – signal (+) 3 – signal (-)	transformer-balanced, for use 110 ohm twisted-pair cabling, AES3 specification
TA3M Master Output Bus		1 – ground 2 – signal (+) 3 – signal (-)	120 ohm output impedance, active balanced. For unbalanced connection, pin-1 ground, pin-2 hot, pin-3 not connected. Mates with Switchcraft TA3F-type connector.
3.5 mm Master Output Bus		tip – signal L ring – signal R sleeve – signal ground	Master Output Bus signal in an unbalanced, consumer-electronic level.
3.5 mm Headphone		tip – signal L ring – signal R sleeve – signal ground	mates with 3.5 mm TRS jack
5-pin LEMO Time code (702T only)		1 – ground 2 – SMPTE TC In 3 – ASCII in/out 4 – tuning out 5 – SMPTE TC out	LEMO B-series connector, pin assignments as viewed on panel-mounted connector
AES3id (S/PDIF) Input		center pin – signal sleeve – ground	BNC female, unbalanced, coaxial connection, 75 ohm connectors recommended
AES3id (S/PDIF) Output		center pin – signal sleeve – ground	BNC female, unbalanced, coaxial connection, 75 ohm connectors recommended
Word Clock Input and Output		center pin – signal sleeve – ground	BNC female, unbalanced, coaxial connection, 75 ohm connectors recommended
FireWire (-1394)		center pin – signal sleeve – ground	6-pin male FireWire connector provides bus-powering for external drives when the unit is DC powered
C. Link In / Out		1 – +3.3 V 2 – Tx (output) 3 – ground 4 – Rx (input) 5 – WC in 6 – TC in	Not a telephone jack! Used to link multiple 7-Series recorders and to connect the CL-1 Remote Control and Keyboard Interface
Hirose 4-pin DC Input		1 – ground 2 – ground, same as pin-1 3 – DC (+) 4 – DC (+)	DC applied to pin-3 will operate and charge the unit when on and off DC applied to pin-4 will operate and charge the unit when on

Specifications

System

Sampling Frequency	internal: 32, 44.1, 47.952, 48, 48.048, 88.2, 96, 96.096, 176.4, 192 kHz external clocking: 32–192 kHz via word clock input
Internal Data Path and Processing	32 bit, 192 dB dynamic range
A/D, D/A Converters	24 bit, 192 kHz sampling rate maximum. A/D converters on socketed, field-upgradeable daughter board
A/D Dynamic Range	114 dB, A-weighted bandwidth 110 dB, 20 Hz–22 kHz bandwidth
D/A Dynamic Range	112 dB, A-weighted bandwidth 108 dB, 20 Hz–22 kHz bandwidth
Metering	76-segment (4 x 19), sunlight-viewable selectable peak, VU, or peak (with or without peak hold) with VU ballistics, variable brightness

Analog Input

(all measurements at Fs 96 kHz, 24 bit unless noted)

Frequency Response	Mic or Line: 10 Hz–40 kHz, +0.1, –0.5 dB (gain controls centered)
Equivalent Input Noise	Mic: –133 dBu max (–135 dBV), 50 ohm source, A-weighted filter Mic: –131 dBu max (–133 dBV), 50 ohm source, 20 Hz–20 kHz BW flat filter, gain fully up Mic: –130 dBu max (–132 dBV), 150 ohm source, A-weighted filter Mic: –128 dBu max (–130 dBV), 150 ohm source, 20 Hz–20 kHz BW flat filter, gain fully up
THD + Noise	Mic: 0.004% max (1 kHz, 22 Hz–22 kHz BW, gain control down, –15 dBu input) Line: 0.004% max (1 kHz, 22 Hz–22 kHz BW, gain control down, +16 dBu input)
Gain (input dBu to –20 dBFS)	Mic (normal gain mode): 24.3–67.4 dB Mic (low gain mode): 9.3–52.4 dB Mic (normal, fades to off gain mode): off (0)–67.4 dB Mic (low, fades to off gain mode): off (0)–52.4 dB Line: –6–18 dB, 0.1 dB increments
Input Impedance	Mic (XLR): 7.5k ohm Line (XLR and TA3): 20k ohm
Input Clipping Level	Mic input: –5 dBu minimum (normal gain mode, gain control fully down) Mic input: +10 dBu minimum (low gain mode, gain control fully down) Line input: +26 dBu minimum (gain control fully down)
Input Topology	Mic and Line: fully electronically balanced, RF, ESD, short, and overload protected; pin-2 hot, pin-3 cold
Gain Matching	Line inputs: ±0.1 dB, channel-to-channel
Common Mode Rejection Ratio	Mic: 40 dB minimum at 80 Hz
High-Pass Filters	40, 80, 160, 240 Hz @ 12/18/24 dB/oct (all menu selectable)
Mic Powering (each XLR selectable)	48 V phantom through 6.8k resistors, 10 mA per mic available, menu-selected per channel in mic or line level positions
Mic Input Limiters	analog (pre-A/D converter), dual-stage optocoupler and FET, –4 dBFS threshold, 20:1 limiting ratio, 5 mS attack time, 200 mS release time

Output Analog

Line Output Clipping Level	+20 dBu minimum, 10k ohm load
Attenuation & Resolution	0–40 dB, 1 dB increments
Output Topology	Line: fully electronically-balanced, RF, ESD, short, and overload protected; pin-2 driven hot, pin-3 driven cold; let pin-3 float for unbalanced connections.

Inputs/Outputs – Digital

AES3-id	75 ohm, 1.0 V p-p, S/PDIF compatible with RCA adapter

Digital Storage

Compact Flash	CF type I, II, and + (microdrive) compatible, FAT32 formatted, up to 2 TB addressable
File Types	WAV (AES-31 format), mono or polyphonic, at supported Fs, 24-bit or 16-bit FLAC, (Free Lossless Audio Codec) MP3 @ 32, 64, 96, 128, 160, 192, 256, or 320 kb/s stereo MP2 @ 64, 96, 128, 160, 192, 256, or 320, 384 kb/s stereo
Utilities	format and speed test for CF and external media

Data Transfer / Control

FireWire	drive-mode, IEEE-1394a compliant, 6-pin FireWire, Windows 2000, XP, Vista, Mac OS X only
C. Link	6-wire modular input and output, RS-232 machine control, word clock, time code transfer

Time Code

Modes Supported	free run, record run, 24 hour run, external time code receive
Frame Rates	23.976, 24, 25, 29.97DF, 29.97ND, 30DF, 30ND
Accuracy	<0.2 ppm, when tuned with Ambient Master Controller, holds TC clock for 8 hours after main battery removal (AA time code battery installed); after 8 hours, retains time of day
Input / Output	20k ohm impedance, 0.3V p-p (–8 dBu) minimum / 1k ohm impedance, 3.0V p-p (+12 dBu)

Powering

Internal Voltages	±16 VDC regulated audio rails 5 VDC data 3.3 VDC data 1.5 VDC DSP core 48 VDC phantom power
Power supply (batteries)	operating cell, removable 7.2 V (nominal) Sony M- or L-type Li-ion, operational from 6–8 V, time code battery, 1.2 V AA nickel metal-hydride
Power supply (external)	10–18 V, 1000 mA minimum, via locking 4-pin Hirose connector, use Hirose #HR10-7P-4P (DigiKey# HR100-ND) for locking mating DC connector; pin-1 (–), pin-2 (–), pin-3 (+), pin-4 (+). See *Powering* section for additional details

Environmental

Operation and Storage	ambient temperature 5–55° C, relative humidity (non-condensing) <80%

Other

LCD Display	202 x 32 pixels, extended temperature, backlit display
Tone Oscillator	100 Hz–10 kHz, variable output, assigned to tracks or outputs (menu-selectable)
Quick Setups	four factory presets, one user setup stored to CF or HD as data file

Dimensions and Weight

Size	45 mm x 209 mm x 125 mm (H x W x D) 1.8" x 8.2" x 4.9"
Mass	unpackaged: 970 grams, (2.14 lbs) without battery

Accessories

Included Accessories

The accessories below are included with the 702T:

- Universal In-Line Power Supply, 100–240 VAC input, 12 VDC, 45 W output (XL-WPH3)
- Li-ion removable rechargeable battery, 2200 mAh
- 3.5 mm to 1/4-inch jack for headphone output extension (XL-14)
- C. Link cable for unit-to-unit linking (XL-RJ)
- Padded man-bag (XL-MAN)
- FireWire Power conditioner (XL-1394)

Optional Accessories

The above accessories are just the start of building a flexible recording kit that can accommodate multiple types of connections. Available accessories from Sound Devices include:

CL-1 	Remote Control and Keyboard Interface used to control the 702T's record start and stop functions using a toggle switch. Allows user to connect a PS/2 keyboard for control and metadata entry.
CS-3 	Production case with high-quality strap for use with Sound Devices MixPre, 302, 702, 702T, 722, and 744T recorders; NP-type battery compartment and accessory pouch for wireless. Built for Sound Devices by CamRade.
CS- MAN	Convenient, padded carry/storage case with handles, handy to store wallets, keys and mobile phones; handcrafted in China.
Wave Agent Beta	WAV file librarian for Mac OS and Windows computers. Wave Agent provides a comprehensive and indispensable range of tools for preparing audio files for problem-free passage through complex production workflows.

XL-1B	TA3F to TA3F cable, used to connect analog outputs to third-party devices with TA3M inputs, 12-inch.
XL-2	TA3F to XLR-M cable, used to connect analog outputs to third-party devices with XLR-F inputs, 25-inch; package of two.
XL-4	Bag of four (4) TA3-F-type connectors.
XL-14	3.5 mm right-angle TRS to 1/4-inch female TRS headphone extension, 12-inch.
XL-B2	Removable, rechargeable, Li-ion battery; 7.2 V, 4600 mAh battery; good to have several spares.
XL-BNC	BNC to BNC cable for word clock and AES3id interconnection, 24-inch.
XL-DVDRAM	An external bus-powered FireWire DVD Multi-drive. Based on the slot-loading Panasonic UJ-85 drive mechanism, the XL-DVDRAM is used with a 7-Series recorder to record directly to optical disk or as a post-record storage volume.
XL-H	Bare Hirose 4-pin locking DC connector (HR10-7P-4P).
XL-LB2	5-pin LEMO to two (2) BNC cable, used to jam to and from video cameras, 60-inch.
XL-LCD	Protective, clear Lexan LCD cover for 7-Series Digital Recorders. Protects the LCD glass from scratches and water. Kit of four covers.
XL-LL	5-pin LEMO to 5-pin LEMO cable, used to connect the 702T time code circuit to Ambient time code sync boxes, slates, and controllers or to jam one 702T to another time code equipped 7-Series recorder; additionally used to jam Aaton cameras from the 702T, 20-inch coiled, 55-inch full extension..
XL-LX	5-pin LEMO to XLR-M and XLR-F cable, used to connect the time code output to SMTPE time code inputs and outputs, 25-inch to XLR-M, 14-inch to XLR-F.
XL-NPH	NP-type battery cup with 24-inch cable terminated in Hirose 4-pin locking DC connector (HR10-7P-4P) at equipment end.
XL-RJ	RJ-12 to RJ-12 for C.Link to C.Link 702, 702T, 722, and 744T recorder linking, 12-inch.
XL-WPH3	AC to DC Power Supply (in-line) 100 - 240V 50/60 Hz input, 12 VDC 3.75 A (45 W) output, Hirose 4-pin DC plug. Supplied with 3-pin IEC cord for use in North America and Japan. It is always good to have a spare.

CE Declaration of Conformity

According to ISO/IEC Guide 22

Sound Devices, LLC
300 Wengel Drive
Reedsburg, WI 53959 USA

declares that the product, 702T and 702T Professional Digital Audio Recorders are in conformity with and passes:

89/336/EEC	EMC Directive
EN55103-1, 1997	EMC-product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use. Part 1: Emissions
EN55103-2, 1997	EMC-product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use. Part 2: Immunity
EN55103-1 Phenomena 2, 3, 1997	Magnetic emissions at 1 meter 50 Hz – 50 kHz
EN55103-2 Phenomena 3, 1997	Magnetic immunity 50 Hz to 10 kHz
CISPR 22 (EN55022) 2003	Radiated and conducted emissions, Class B
EN61000-4-2 (2001)/ IEC61000-4-2 (2001)	ESD, ±4 kV contact, ±8 kV air discharge
EN61000-4-3 (2001)/ IEC1000-4-3 (2001)	Radiated RF immunity, 10 V/m, 80% 1 kHz amplitude modulation
EN61000-4-4 (2001)/ IEC61000-4-4 (2001)	AC power ports: EFT Burst, I/O lines, ±0.25 kV to ±1.0 kV, power line ±0.5 kB – ±1 kV
EN61000-4-4 (2001)/ IEC61000-4-4 (2001)	EFT Burst, I/O lines, ±0.25 kV to ±1.0 kV, power line ±0.5 kB – ±1 kV
EN61000-4-5 (2001)/ IEC61000-4-5 (2001)	Surge ±1 kV differential mode (line-to-line), ±2 kV common mode (line-to-ground)
EN61000-4-6 (2001)/ IEC61000-4-6 (2001)	Conducted RF immunity, 3 V, 80% @1 kHz amplitude modulation
EN61000-4-11 (2002)/ IEC61000-4-11(2001)	Voltage dips and short interruptions at test voltage level: 0% V unominal @ 70% V unominal @ 25 period

Tested by L. S. Compliance, Inc. Cedarburg, Wisconsin
March 15, 2006

Matthew Anderson
Director of Engineering
Sound Devices, LLC

Software License

End-user license agreement for Sound Devices 7-Series Embedded Software / Firmware

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Governing Law

This agreement and limited warranty are governed by the laws of the state of Wisconsin.

Warranty & Service

Sound Devices, LLC warrants the 702T and 702T Portable Audio Recorders against defects in materials and workmanship for a period of ONE (1) year from date of original retail purchase. This is a non-transferable warranty that extends only to the original purchaser. Sound Devices, LLC will repair or replace the product at its discretion at no charge. Warranty claims due to severe service conditions will be addressed on an individual basis. THE WARRANTY AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. SOUND DEVICES, LLC DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SOUND DEVICES, LLC IS NOT RESPONSIBLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING FROM ANY BREACH OF WARRANTY OR UNDER ANY OTHER LEGAL THEORY. Because some jurisdictions do not permit the exclusion or limitations set forth above, they may not apply in all cases.

For all service, including warranty repair, please **contact Sound Devices for an RMA** (return merchandise authorization) before sending your unit in for repair. Product returned without an RMA number may experience delays in repair. When sending a unit for repair, *please do not include accessories, including CF cards, batteries, power supplies, carry cases, cables, or adapters unless instructed by Sound Devices*.

Sound Devices, LLC
Service Repair RMA #XXXXX
300 Wengel Drive
Reedsburg, WI 53959 USA
telephone: (608) 524-0625

Technical Support / Bug Reports

For technical support and bug reporting on all Sound Devices products contact:

Sound Devices, LLC
E-mail: support@sounddevices.com
web: www.sounddevices.com/contact_support.htm
Telephone: +1 (608) 524-0625 / Toll-Free in the U.S.A.: (800) 505-0625
Fax: +1 (608) 524-0655

Sound Devices hosts a discussion forum for 7-Series recorders. The URL is:

http://forums.sounddevices.com

Sound Devices cannot guarantee that a given computer, software, or operating system configuration can be used satisfactorily with the 702T based exclusively on the fact that it meets our minimum system requirements.

Please check with your software editing application to make certain that it is compatible with the file type selected.

SOUND DEVICES

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